SUBSIDIES AND THE ENVIRONMENT: WITH SPECIAL REFERENCE TO AGRICULTURE IN INDIA

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CHAPTERS

1. Introduction

The objective of this study is to examine the interface between subsidies and environment with a view to highlighting both the positive and adverse roles that subsidies may play in affecting the environment. While subsidies will be interpreted in a broad way, our focus will be on subsidies that emanate from government budgets in India. Environment is affected by subsidies in a variety of ways. On the one hand, there are subsidies specifically designed to promote or benefit some aspect of environment, e.g., subsidisation of an afforestation programme. On the other hand, there are subsidies that, while promoting some other economic objective (like agricultural output), have an indirect, and sometimes, unanticipated effect on environment. Often these effects may be adverse or harmful. In this study, an endeavour is made to identify and quantify budgetary subsidies that have a bearing on environment, whether direct or indirect. While attempting to examine the nature and impact of the subsidy induced effects on environment, we especially focus on subsidies that often have a dual impact, positively affecting some aspect of the economy, and adversely affecting the environment during some phase of the life cycle of the subsidisation process.

2. Subsidies: Meaning

It is useful to start by clearly defining the term subsidies. This, however, is not a straightforward task. Houthakker (1972) had perceptively observed that "the concept of a subsidy is just too elusive to even attempt to define". Prest (1974) had also noted that economists have not settled upon a commonly acceptable definition. The House Committee on Agriculture of the U.S. Congress (1972) acknowledged that "the definition of a subsidy, like that of beauty, varies with the beholder". The term "subsidy" has been used in the literature in a variety of ways, often implying different meanings and connotations.

The word subsidy is derived from the Latin word 'subsidium', meaning 'troops stationed in reserve' which implies coming to assistance from behind or indirectly. The dictionary (Concise Oxford) explains the term as: "money granted by state, public body, etc., to keep down the prices of commodities, etc.". The Joint Economic Committee of the U.S. Congress (1972) had defined subsidy as government assistance for which no equivalent compensation is received in return, but the assistance is conditioned "on a particular performance by the recipient".

Economists have even thought that the term should be differently defined for different contexts. Thus, Stephan Barg (1996) has suggested three different definitions for economic, fiscal, and environmental issues. The definitions suggested by him are given below:

Economic Definition

"A government-directed, market-distorting intervention which decreases the cost of producing a specific good or service, or increases the price which may be charged for it".

Fiscal Definition

"A government expenditure, provision for exemption from general taxation, or assumption of liability which decreases the cost of producing a specific good or service, or which increases the price which may be charged for it".

Environmental Definition

"An environmental subsidy consists of the value of uncompensated environmental damage arising from any flow of goods or services".

It can be seen that environmental subsidies have been defined in the broadest way incorporating any flow of benefits that arise from environmental degradation, even if they are not government-directed, and do not pass through a market mechanism, and reflect indirect costs. For example. harvesting a forest without reforesting, or without recognising non-timber values, involves an unpaid cost. The cost of reforesting by the harvesters remains unpaid leading to environmental damage. This amounts to subsidisation of these harvesters, to the extent of the unpaid cost, by the user of the environment, i.e., the society. Barg recognises that even this definition does not fully address the need to avoid irreversible harm to an ecological system for which there may be no substitute. In such a case, the value of the environment/ecological system may have to be set at infinity. However, instead of taking such an extreme view, more practical ways need to be worked out to evaluate the costs of environment damage so that policy changes can be determined.

In studies dealing with budgetary subsidies, these are often defined as unrecovered costs of public provision of private goods [for example, see Srivastava and Sen et. al, (1997)]. In the environmental definition of subsidies mentioned above also, subsidies are taken as unrecovered cost. The concept of cost however is broader than the one usually applied in the budgetary studies. In these cases, the cost to the society arises from uncompensated damage to the environment commonly shared by all members of the society by activities producing private goods (even if sometimes provided by the public authorities). These uncompensated losses may arise both when the concerned private goods are subsidized and when they are not subsidized. In case, there is a budgetary subsidy to encourage the production/use of such a good (for example, fertiliser) there are two types of unrecovered costs: those that constitute the difference between the cost of provision of the good/service and the receipts from the users, and those that amount to the value of the damage to the environment because of the use of the said good/service which needs to be paid by its users to the society for the damage to the environment. The two unrecovered costs are both subsidies, and can be added up.

3. Subsidies as Means of Fiscal Intervention

Taxes and subsidies are two key fiscal instruments that a government has at its command for modifying market determined outcomes in an economy. While taxes withdraw money from circulation, subsidies inject money into circulation. Taxes appear on the revenue side of government budgets, while subsidies affect the expenditure side. Subsidies can have a major impact in improving welfare of the society provided these are designed and administered efficiently to serve a clearly stated set of objectives. However, subsidies can also be very costly if they are poorly designed and inefficiently administered.

More specifically, subsidies may be viewed as the converse of an indirect tax. In both cases, the fiscal instrument affects the economy through the commodity market. An indirect tax raises the price of the taxed commodity and thereby leads to a lowering of the quantity at which the market for that commodity is cleared, other things remaining the same. A subsidy, on the other hand, lowers the relative price of the commodity and therefore increases the quantity at which the market is cleared. As such, subsidies are a potent means for raising the consumption of a commodity or service, and thereby augment welfare. Subsidies in areas such as education, health and environment are advocated on grounds that their benefits are spread well beyond the immediate recipients, and are shared by the population at large, present and future.

However, apart from commodity specific effects, subsidies also have macro effects and indirect effects arising from the interdependence between sector or markets. The macro effects arise because government subsidies must be financed by current resources which are obtained through taxes or borrowing. The size of the government expenditure increases due to subsidies and their financing through additional taxation and/or fiscal deficit has macro implications that exert themselves through their impact on the rate of interest and other relative prices. The indirect effects of subsidies arise because of the inter-linkages in the production process. Subsidising a commodity not only affects the price of this commodity but also the prices of several other commodities in the production of which the subsidised good may be used as an input. Several of these indirect effects may be quite harmful and unanticipated. The case of environment being adversely affected by excessive subsidisation is a prime example. Excessive use of the subsidised product like fertilisers may do long term damage to the fertility of soil. Similarly, subsidy induced excessive use of water affect the fertility of land due to soil erosion and salinity. It is therefore critical that the concept of subsidies is clearly worked out, the case for subsidisation of a specific commodity is well thought out, and subsidies are properly designed and targeted and carefully administered in actual practice. These issues have been addressed in the ensuing discussion.

4. Case for Subsidies

Subsidies are advocated primarily on ground of positive externalities, i.e., cases where the benefits are spread well beyond the immediate users. Other grounds like protecting a sub-group of population like the farmers, or protecting an industry during its development phase are also invoked. However, these grounds should be carefully considered before their validity may be accepted and even then these may lead to only temporary subsidisation.

The issue of subsidy arises in the context of the provision of a service/good, where a user/beneficiary is identifiable, and the extent of his consumption is measurable. To the extent that the cost of providing a good, financed by the government budget, is not paid for by the user, it is paid for by the taxpayer. Such a subsidisation by the taxpayers may become justifiable when the benefit of the good/service is spread beyond the user or the direct beneficiary. Education and health are important examples of positive externalities. When an individual is educated, he may have benefited himself. But by his education, his neighbours, and the society at large would also benefit if he turns out to be sociable and a law abiding citizen as a result of his education. In such circumstances, the market leads to a less than socially desirable level of consumption. This is because, individuals express their demand for a certain good taking into consideration their private benefits and their ability to pay. Their demand reflects benefits to themselves and not to the society as a whole. Since the benefits to the society are additional, the society may try to induce a higher level of demand through subsidies. Such extended benefits may relate both to consumption and production activities.

Budgetary subsidies arise when the government fails to recover the cost of providing the service from the users by such means as fees, tariffs and user charges. Subsidies also arise when the government procures a commodity from the sellers, and then sells it at prices that do not cover the procurement price and the cost of storage, handling, transmission, etc. Such is the case for food subsidies in India. Apart from being costly and cumbersome, widespread intervention by the government in the market impedes the ability of the market to respond to changing situations.

Subsidies operate by altering the relative prices of a good/service and usually create a wedge between consumer prices and producer costs. This leads to changes in demand/supply decisions. Subsidies are often aimed at: (i) inducing higher consumption/production; (ii) offsetting market imperfections including internalisation of externalities; and (iii) achievement of social policy objectives including redistribution of income. If markets do not allocate resources to their most efficient use, subsidies may be used to offset market imperfections.

5. Forms of Subsidies

Subsidies can be introduced or delivered into the system in a variety of forms and by a variety of means. Subsidies may be explicitly provided for in the budgets. They may also be generated through administering or regulating prices. Among the important forms of subsidies, the following may be mentioned [listed in Srivastava and Sen, et. al. (1997)].

▪ Cash subsidies (e.g., food, fertiliser, export)
▪ Interest or credit subsidies (loans given at lower than market rates)
▪ Tax subsidies (e.g., tax exemption of medical expenses, deducting mortgage interest payment from taxable income, postponing collection of tax arrears)
▪ In-kind subsidies (provision of free medical services through government dispensaries, provision of goods to target population in physical form)
▪ Equity subsidies (investment in equity in State enterprises giving low dividends)
▪ Procurement subsidies (e.g., purchase of foodgrains at assured higher than market prices)
▪ Regulatory subsidies (fixation of price/quantity in the case of goods produced by public/private sector

Often subsidies as cash are delivered to an intermediate agent (for example, state governments in the case of food subsidy; fertiliser industry in the case of fertiliser subsidies) while the ultimate beneficiary (consumer, farmer) gets the benefit in the form of reduced prices.

6. Subsidies and Environment

As already noted, subsidies range from financial transfers to opportunity costs, and they can be both direct and indirect. When subsidies are interpreted as opportunity costs, they have a very wide connotation. In an environmental context, subsidies are often interpreted as opportunity costs. These opportunity costs arise due to environmental externalities which may be negative in nature. For example, car drivers pollute the atmosphere for all citizens who remain uncompensated. Thus, car drivers effectively gain a benefit at everyone's expense. In other words, the common citizens subsidise the car owners. Similarly, when farmers spray pesticides, they introduce toxic effects into the commonly shared ecosystems. Industrialists often introduce pollutants into water bodies – a common property resource. Similarly, when loggers over-exploit forests, habitats of everyone's wildlife and biodiversity is depleted. These activities amount to uncompensated services from society to individuals and can be read as subsidisation of individuals by the society.

Although, this kind of subsidisation is widespread, it almost goes unnoticed. The conventional GNP accounting generally presents such activities as economic pluses, whereas there is a case to consider these as making a negative contribution to output. When soil erosion causes farmers to apply extra fertiliser to compensate for loss of plant nutrients, this is viewed as an economic activity to be recorded as an additional item for GNP—while the costs to society are not taken into account. Barg (1996) gives some examples to illustrate the point. The Exxon oil spill caused clean-up efforts costing $3 billion; the GNP arithmetic counted them as an advance for GNP. When Kobe city was hit by an earthquake, one Japanese economist added up the rebuilding activities and declared the country's economy had actually come out ahead.

Environmental degradation may result from both market failures and policy failures. Policy instruments for containing environmental degradation within acceptable thresholds have mainly focused on market failures. Fiscal instruments aim to address market failures such as externalities, poorly defined or absent property rights and absence of pricing or inadequate pricing of environmental resources through either direct or market oriented mechanisms. However, when economic policy leads to the use of such fiscal instruments as subsidies which themselves become a cause of environmental degradation, these may be cited as instances of policy failures. Several examples of the environmentally detrimental subsidies which are introduced as part of a conscious economic policy may be cited. For example, subsidisation of agriculture through subsidisation of water or fertiliser or administered prices can foster over-loading of croplands, leading to erosion and compaction of top soil, pollution from synthetic fertilisers and pesticides, and denitrification of soils. Subsidies for road transportation can engender atmospheric pollution. Subsidies for water encourage misuse and overuse of this scarce resource.

Thus, in the context of environment, subsidies can be divided into two groups: environment-promoting subsidies and environment-degrading subsidies. It is quite likely that the volume of environment promoting subsidies is small, and its impact is limited. On the other hand, the volume of the environmentally detrimental subsidies is large, although its environment degrading impact remains unrecognised, unmeasured, and unmonitored.

7. Perverse Subsidies: The International Concern

In recent years, the phenomenon of environmentally perverse subsidies has been recognised in the literature, and there is also a widespread international concern about environmentally harmful subsidies. The adverse effects of environmental pollution engendered by excessive subsidisation of one country may in fact have cross-country effects. Subsidies for fossil fuels aggravate pollution effects such as acid rain, urban smog and global warming. These effects have cross-border effects.

It has been estimated (Myers, et. al., 1998) that perverse subsidies in the world may amount to as much as $1.5 trillion, which is larger than the economies of all but five countries in the world (using purchasing power parity for the GNPs of China and India). Ironically the total of almost $1.5 trillion is two and a half times larger than the Rio Earth Summit's budget for sustainable development—a sum that governments dismissed as unthinkable. The main findings of Myers, et. al (1998) indicate that (i) total subsidies in the world may be around $1,900 billion per year, and perverse subsidies may be as large as $1,450 billion; (ii) perverse subsidies have the capacity to (a) exert a highly distortive impact on the global economy of $28 trillion, and (b) inflict grand scale injuries on our environments. It is also noted in Myers, et. al. (1998) that the OECD countries account for two thirds of all subsidies and an even larger share of perverse subsidies; that the United States accounts for 21 percent of perverse subsidies; and that the single sector of road transportation accounts for 48 percent of all subsidies and 44 percent of perverse subsidies.

While the two totals—overall subsidies of almost $1.9 trillion per year, and perverse subsidies, approaching $1.5 trillion per year may appear to be large, these might still be underestimates. Myers observes that many environmental externalities (including what could prove to be as big as the rest put together, *viz*., global warming) are either underestimated or omitted from the final results through sheer lack of documentation of economic costs entailed. Thus, the total for perverse subsidies, approaching $1.5 trillion per year, should be considered as an underestimate.

8. Budgetary Subsidies in India

In the volume on Government Subsidies in India (Srivastava and Sen, et. al., 1997), on which the Discussion Paper on Government Subsidies in India brought out by the Ministry of Finance in May 1997 was based, the Central subsidies were estimated at Rs. 43089 crore in 1994-95. For the States, the aggregate amount of subsidies, at Rs. 93754 crore, was more than twice that at the Centre. Together, these amount to Rs. 136844 crore constituting 14.35 percent of GDP at current market prices in 1994-95 with reference to the old (1980-81 base) GDP series. With reference to the new (1993-94 base) series, these amounted to 13.51 per cent. If we take subsidies net of surplus (Centre and all States) it comes to 13.36 percent of GDP in 1994-95 (12.5 per cent with reference to the new GDP series). The estimates of subsidies in social and economic services are more or less in line with the division of expenditure responsibilities in this area. In the provision of social services, the Centre has had a limited role, and its subsidies in this sector are only a small fraction of the total subsidies given by the government as a whole. Nearly 90 percent of the subsidies in social services and a little more than 55 percent of subsidies in economic services are State government subsidies.

If only non-merit subsidies, covering services that have low or no externalities, are taken into account, they amounted to 10.93 percent of GDP (10.29 per cent with reference to the new GDP series). The average all-India recovery rate for these non-merit subsidies is just 8.98 percent, implying a subsidy rate of more than 90 percent.

For merit goods having large externalities like elementary education and primary health, the subsidies provided by the state governments in the category of 'social services' amounted to Rs. 18837.47 crore in 1994-95. State subsidies on non-merit social services are also much higher than those provided by the Centre. As far as economic services are concerned, Central subsidies on non-merit services are almost as large as those are for the States, the two figures being Rs. 33627.59 for Centre and Rs. 38837.37 crore for the States. In the aggregate, for non-merit economic services, the recovery rate is 11.17 percent which is quite low, and the Centre and the States share responsibility for this poor performance almost in equal measure.

In social services, there are no surplus sectors in general; only in a few cases, individual States show some surplus, which are essentially non-recurrent in nature. While human development is legitimately a major concern of the welfare State, it may be necessary to reassess policies in this area at the micro level to temper this concern with the equally legitimate concern for the burgeoning public expenditures. This is particularly important if inadequate targeting and leakages are major problems with these subsidies.

The disaggregated picture had shown large subsidies in the areas of agriculture, irrigation, industries, power (excluding petroleum), transport and higher education. In these cases, the services involved can be priced in varying degrees. There is scope for augmenting cost recovery in these areas. A substantial reduction in subsidies in the six sectors noted above would make a real dent on the problem of rising government expenditures. This would need to be done both by reducing expenditure in non-priority areas within these sectors and by ensuring better recoveries. Some of the subsidies, as discussed earlier, may need to be reduced for efficiency reasons also (e.g., irrigation and power).

Even while the available estimates indicate large volumes of implicit budgetary subsidies, these estimates do not take into account the environmental subsidies that arise due to negative externalities that were discussed in the previous section. This concern is addressed in the present work.

9. Over Subsidisation of Services and Environmental Damage

Measurement of the volume of subsidy is often not enough. What is required is the measurement of excess subsidisation, that is, the volume or the degree of subsidy provision in excess of what is desirable or optimal. In evaluating a subsidy programme, not only the actual volume of subsidy, but also the optimal subsidy needs to be estimated. This requires a much larger information base regarding the objectives and the actual features of the sector including demand and supply functions. It also requires estimation of externalities in which case social demand function and private demand function may both be required.

The same subsidy programme may play different roles at different times. As such, subsidisation programmes should not be thought of as static exercises. Rather they should respond to their past history and the changes that take place in the sector. Viewing subsidies in terms of a life cycle where they may grow in importance initially or in an expansion phase, reach a maximum and then are rolled back in the contraction phase may be the best method of promoting relevant objectives in a sector. When appropriate changes do not take place in response to the history of the subsidy and the external environment, the expansion phase may be over stated and contraction may prove to be very difficult. Subsidy programmes that are not scrutinised with respect to their desired life cycle pattern may prove to be more harmful than beneficial. Recognising a suitable life cycle is especially important in the context of environment.

Many subsidies have been constructive at the time of their introduction, but have later become perverse. They have completed their original purpose but have not been eliminated afterwards. The American West was settled partly in response to a host of subsidies established by the United States government in the late 1800s. The aim of these subsidies was to encourage settlers to exploit the West's resources as rapidly and widely as possible, which was an eminently desirable goal at the time. Today, however, the West's settlement frontier has long since closed, and its resources are more commonly viewed as a public trust to be carefully managed for all Americans both now and in the future. Resource exploitation has often degenerated into over-logging of forests, over-grazing of grasslands, depletion of watersheds, over-pumping of aquifers, decline of biodiversity, and pollution of water and air from mining, sometimes with toxic wastes. Yet many of the original pro-exploitation subsidies remain in place, even though they are now harmful to both the environment and the economy at large and over the long term.

10. Environmentally Perverse Subsidies: Sources and Examples

In general, subsidies may be considered perverse environmentally when these lead to:

i. Production processes that would not otherwise get off the ground. Growing of rice and alfalfa in California desertlands, and continuing with over-exploitation of fish stocks that are already so depleted that they should be relieved of further exploitation forthwith have been cited as examples.

ii. Reduction of costs so much that natural resources are over-exploited or wasted. Over-loading of cropland soils, misuse of water stocks and over-logging of forests may be cited as examples.

iii. Deterrence to efforts at sustainable exploitation, cost-saving technologies and improved management activities such as the harvesting of natural forests (for example those in the U.S. Pacific Northwest, Canada's British

Columbia, Southeastern Australia and Borneo) militates against a shift toward plantation forestry.

iv. Often, subsidies, while attempting to benefit one economic area result in harming others to the extent that their net impact is negative. Agricultural subsidies, especially in the form of protecting incomes of farmers or reducing their input costs are clear examples. In the agricultural sector in particular, subsidies that stimulate practices that degrade the natural resources underpinning agriculture, notably soils and water; which encourage overuse of agro-chemicals such as synthetic fertilisers and pesticides; and subsidies that reduce bio-diversity - especially the natural enemies of insect pests and weeds – and the genetic variability that enhances crop productivity and resists new diseases, are examples of perverse subsidies.

v. Subsidies may be considered environmentally perverse when these foster activities that result in environmental harm at the site in question (over-logging of a forest, water logging of a rice paddy) or further afield (downstream siltation, acid rain), and whether immediately (urban smog) or later (global warming).

vi. When subsidies encourage inefficient use of fossil fuels with their many polluting impacts, or stimulate development of nuclear energy with its many problems of environmental safety and toxic wastes, they may be considered environmentally perverse.

vii. Subsidy induced inefficient and wasteful use of water, especially now that water is becoming scarce in many regions, is also a similar example.

viii. Over-exploitation of forests and fisheries, eventually causing stocks to fall away to commercial if not biological extinction induced by subsidisation leading to large scale environmental pollution resulting in acid rain, ozone-layer depletion, and global warming among other climatic dislocations also qualify as example of perverse subsidisation.

11. Reforming Subsidies

It is high time, therefore, that the phenomenon of perverse subsidies is addressed head-on. Many governments are espousing the marketplace economy with its reduced scope for government intervention. Many governments also face fiscal constraints that give them further incentive to reduce activist roles in their economies. So the political climate for radical reform of subsidies is probably better than it has been for decades. The transition economies in particular face an admirable opportunity thanks to their political and economic liberalisation.

There are various policy options available. One generalised option is to be opportunistic and to seize on emergent "windows" such as the recent strong political shift towards markets. The credo of the marketplace stands opposed to subsidies, let alone perverse subsidies, as a form of government intervention that *ipso facto* must be distortive and counter-productive (this applies especially to the economies in transition with their switch to market liberalism). Resistance to subsidies in general also stems from the privatisation ethos, which is becoming widespread.

There are various ways to overcome these obstacles. One is to formulate alternative policies that target the same subsidy objectives better, while also compensating losers. A related measure is to develop an economic-policy context that encourages subsidy removal through, e.g., reducing government controls generally and freeing up markets. A subsidiary measure is to introduce "sunset" provisions that require surviving subsidies to be re-justified periodically, thus avoiding the entrenchment problem. All these measures can be strongly reinforced by promoting transparency about perverse subsidies, especially in the context of their impacts both economic and environmental, and their costs to both taxpayers and consumers.

The main challenges in reducing economically and environmentally perverse subsidies may be considered as political and institutional and not analytical. In short, we already have a good deal of information about their existence and their effects, but it is the reform of the subsidy regime which is the key policy problem.

12. Subsidies Affecting Environment: Critical Issues

In the context of the discussion above, some critical issues that may be raised and examined in this study may be listed as below:

i. What are the areas/goods in India where the activity is subsidized by the public authorities where the public pays a double cost in the form of unrecovered budgetary cost and in the form of uncompensated environmental damage?

ii. What may be the volume of the two types of subsidies?

iii. When subsidisation of goods/services have mixed effects, positive with respect to one aspect, negative for another, how should the subsidy programme be evaluated or modified?

iv. What are the areas where the budget supports an environment-promoting activity? In such cases what may be the volume of subsidy involved?

v. Are we under-subsidising the promotion of environment?

vi. Are we over-subsidising activities that damage the environment?

vii. What policy changes may be introduced in terms of modifying our subsidy regime for protecting and promoting our environment?

13. Outline of Study

The objective of the present study is to –

i. Provide an analytical framework for identifying the role and impact of subsidies on the environment — distinguishing, in this specific context, between positive and perverse subsidies;

ii. Identify and measure the volume of environmentally friendly budgetary subsidies in India, both explicit and implicit, and analyse their inter-regional distribution; and

iii. Focussing on agriculture and degradation of natural resources in India, develop a framework to assess the implications of subsidies like those relating to irrigation water, power and fertilisers on environmental degradation and identify the key indicators to be used for assessing the impact of subsidies on environment.

This study is divided into five chapters. Chapter 1 deals with concepts and issues. Chapter 2 focuses on estimating environment-related subsidies that emanate from government budgets. Both positive and perverse subsidies are included as long as they have a bearing on environment. The magnitude of subsidies are presented for 3 years, namely; 1995-96, 1996-97 and 1997-98 for the central and the state governments in India. The inter-state pattern of environment related subsidies are analysed with a view to highlighting critical features and deriving some policy conclusions. Chapter 3 provides a framework to identify the impact and assess implications of environmentally perverse subsidies on environment. This chapter also presents a dynamic framework for obtaining an environmentally optimal nitrogenous fertiliser price regime. Chapter 4 presents international best practices in controlling environmental degradation caused due to overuse of fertilisers, irrigation and pesticides. Finally, chapter 5 presents main findings and conclusions of the study.

In analysing the environmentally perverse subsidies, this study will focus on three agricultural inputs – power, irrigation and fertiliser, in which such perverse subsidies are reported to be pervasive. In so far as environmentally friendly subsidies are concerned, this study will attempt to cover all such subsidies which emanate from the government budgets. In particular, the following may be listed: soil and water conservation, forest conservation, development and regeneration, afforestation and ecology development, flood control, anti-sea erosion projects, drainage, non-conventional sources of energy, environmental research, prevention and control of pollution, and sewerage and sanitation.

What are Pensions

- Periodic allowance for meritorious service
- Transfers to those exiting the work-force
- System of Social Security (Otto Von Bismarck, 1889) encompassing poor, old, retired elders (1899), widow(er)s, orphans, disabled and destitutes (1891)
- Not by way of charity, Not an ex-gratia payment, Not a purely social welfare measure. It is a right enforceable by law

Before proceeding any further I would just like to collect some responses on What in your view is pensions?

Let me try to give you a historical perspective

reward

It was a Periodic allowance for meritorious service (an award)

But over centuries it evolved into a ~~reward~~ an award to those exiting service

Later metaporphosing into a System of Social Security (heralded by Otto Von Bismarck, 1889) encompassing poor, retired elders (1899), widow(er)s, orphans, disabled and destitutes (1891) and even unemployed.

The existing legal position in India, is that Pension is Not by way of charity, Not an ex-gratia (an act of grace, without acceptance of liability) payment, Not a purely social welfare measure but that it is a right enforceable by law

Banking Cycle

- Over lending - Bad debt

Structure Credit Market,

Lags and discontinuities.

Loss of information

Perverse incentive in

- financial incentives to do volumes.

- Credit rating agencies - apply to a wide range of products.

Losses in N America

~~Sell~~ Management projects no fear loss

~~profits~~

$x_i \geq 0$

(1) Improve world regulatory supervision.

Rating

Mortgage origination.

(2) Liquidity

(3) Cyclical measures of risk - they all attempt to exaggerate the cycle.

, or (1)

Whatever the level of supervision - there are always possibilities of errors.

(2) Bank legislation - protect retail depositors

(3) Continue with a single authority

What does this do to the world Economy

↳ There is a possibility of world recession.

1st Shock

. Credit Shock

2nd Shock

Price shock. commodities, oil, food. / Inflation.

Supervising and financing

ESTIMATING ENVIRONMENT RELATED BUDGETARY SUBSIDIES 2

1. Introduction

In this chapter, we attempt to measure the volume of budgetary subsidies in India that have a bearing on environment. Both the Central and State budgets are covered. Subsequently, these environment related subsidies are divided into two categories comprising one group where the subsidies are designed to have a positive impact on the environment, and another group where, as a result of subsidising some other aspect of the economy, environment may get adversely affected. The former may be called positive and the latter (environmentally) perverse subsidies.

In the case of some subsidies there may be *prima facie* grounds to believe that these will have a positive impact on environment. For example, subsidies for sewerage and sanitation or subsidies for non-conventional sources of energy are likely to have a beneficial effect on environment. Subsidies like environmental forestry and wildlife, soil and water conservation and fisheries can also be considered as necessary for environmental protection.

However, there are several budgetary heads, where subsidisation may have a mixed or adverse effect. For example, in the case of 'irrigation', subsidisation may lead to both positive and negative effects. It is important to note that it is not the *activity*, but the *subsidy* that may be classified as perverse. Irrigation as an activity is extremely beneficial to agriculture. In fact agricultural land covered under irrigation in India is about 35 per cent which is quite poor. So, apparently any subsidy targeting irrigation should have a positive effect. But excess use of water due to excess subsidisation of irrigation may damage the fertility of soil, leading to an adverse impact. When subsidy is given in excess, it leads to problems that may sometimes be unanticipated. Environment may be adversely affected by the overuse and inefficient use of resources due to improper pricing engendered by the subsidies. It is therefore important that, while framing a subsidy policy and determining agricultural prices, the shadow price of environmental resources be properly taken into account.

In the case of some other items also, the impact of subsidy may be mixed, such as command area development programmes and agricultural research in forestry. Many subsidy-induced research programmes may contribute to commercial forestry rather than environmental forestry and may ultimately actually induce a negative consequence for the environment. Similarly, large irrigation projects may not be the best way of providing irrigation for agriculture. How these areas should be dealt with is an important question.

2. Environment-Related Budgetary Subsidies

Budgetary subsidies may be explicit or implicit. Explicit subsidies are explicitly provided for as a separate budgetary item, like fertiliser subsidy, and constitute a distinct budgetary outflow. Implicit subsidies have a wider connotation covering unstated opportunity costs. In a budgetary context, implicit subsidies may be defined as unrecovered costs in the provision of publicly provided services, provided these services may be classified as other than public goods. This implies that these services are delivered to users who may be identified, and often, the extent of use/consumption of good may be measured. Public goods, on the other hand, are characterised by the twin characteristics of non-rivalry and non-excludability. These are goods that are collectively consumed and the consumption by one does not reduce the availability of the good for another.

We have considered general services comprising such services as administration, police, justice, jails, etc. as public goods. The case of subsidisation is relevant for social and economic services. From among these, the following budgetary heads were considered to have relevance for environment. Services identified as clearly having a positive effect on environment are listed in Group A, and those likely to have an adverse or mixed effect are grouped in category B.

Group A

1. Sewerage and Sanitation
2. Soil and Water Conservation
3. Fisheries
4. Forestry and Wildlife
   - Forest Conservation, Development and Regeneration
   - Environmental Forestry and Wildlife
5. Agricultural Research and Education
   - Soil and Water Conservation
   - Fisheries
   - Forestry
6. Special Areas Development Programme
   - DPAP / Desert Development Programme
   - Wasteland Development Programme
7. Flood Control and Drainage
   - Flood Control
   - Anti-Sea Erosion
8. Non-Conventional Sources of Energy

Group B

1. Major and Medium Irrigation
2. Minor Irrigation
3. Command Area Development Programme
4. Fertiliser
5. Pesticide and Chemicals

Classification of service heads in the budget may be done in two stages. First, all those heads among social and economic services which have any bearing on environment, direct or indirect, need to be identified. Then a choice is to be made regarding those subsidies which can be placed in Group A. The criterion that should be followed is to identify those services which have a "direct and positive" effect on environment. The remaining services are placed in Group B. Most Group B items will be judged by the fact that the primary objective of the service is not related directly to environment, and the adverse or mixed effects are likely to be generated indirectly or incidentally.

The volume of subsidies has been estimated for these budgetary heads for all the Indian states and the Central Government for the years 1994-95, 1995-96 and 1996-97. As already noted, the estimated subsidies are divided into two groups for further analysis. In Group A, subsidies that have a positive impact on environment are put together. In Group B, subsidies that have an adverse or mixed effect on environment are put together. All the basic data are drawn from the Finance Accounts of the Central and the State governments.

3. Measuring Budgetary Subsidies: Methodology

In this study, subsidies are measured as unrecovered costs of governmental provision of goods and services that are not classified as public goods. The unrecovered costs are measured as the excess of aggregate costs over receipts from the concerned budgetary head. The methodology, described in detail in Srivastava and Sen (1997) and Srivastava and Amarnath (2001), has been followed. The main elements of the methodology are described below.

Measurement of subsidy requires (i) identification of budgetary heads that can be interpreted as other than pure public goods, (ii) estimation of costs, and (iii) estimation of receipts. Costs themselves have two components: current or variable costs and annualised capital costs. The current (revenue) expenditure on a budgetary head is taken as the variable cost. The capital cost is worked out as the expected annual return on the stock of capital in the form of equity, loans or ownership of capital assets.

Costs:

Aggregate costs may be written as:

$C = RX + (i+d^*) K_0 + iZ_0$

Here, RX = Revenue expenditure on the service head subject to adjustments described below:

i = Effective interest rate

d^* = Depreciation rate

K_0 = Aggregate capital expenditure at the beginning of the period pertaining to the budgetary head

Z_0 = Sum of loans and equity investment at the beginning of the period pertaining to the budgetary head

Receipts:

Aggregate receipts may be written as:

$R = RR + (I + D)$

Here, RR = Revenue Receipts

I = Interest receipts

D = Dividends

Subsidy is defined as:

$S = C - R$ where S is the calculated subsidy.

In calculating the current costs, revenue expenditure on the service head is to be taken after deducting transfer funds and adding transfer from funds. This is because when funds are transferred to funds, they are only earmarked for use at a later time, and do not constitute current spending. On the other hand, transfer from funds add to the current spending on the service.

Estimation of Capital Cost:

In the calculation of capital costs, accumulated capital stock pertaining to a service head is divided into three parts: (I) investment in physical assets in departmental activities including departmental enterprises, (ii) investment in equities, and (iii) loans. In all cases, accumulated investments as outstanding at the beginning of the financial year is taken. In the case of physical capital a depreciation rate is applied. The methodology is explained in detail in Appendix I.

Since estimates are made with respect to a financial year, annualised cost of capital needs to be estimated. In this context, two rates are important, namely: the depreciation rate and the effective interest rate.

We have followed the methodology described in Srivastava and Amarnath (2001) for estimating the depreciation rate. The average life of a capital asset is taken to be 50 years. The depreciation rate is worked out as a function of the parameters, viz., the rate of growth of nominal investment (z) and the long term rate of inflation (p). This methodology is relevant in the case of investment data given in Finance Accounts which are accumulated as stock in the terms of the nominal values prevalent in the year of acquisition of the asset. The depreciation rate is given by d* as indicated below.

$$d^* = 1/50.\frac{\{1 + w + w^2 + \dots\dots\dots + w^{49}\}.(1 + p)}{\{1 + x + x^2 + \dots\dots\dots\dots + x^{49}\}}$$

with $w = (1+p)/(1+z)$

and $x = 1/(1+z)$

Here, p is the long term rate of inflation and z is the growth rate of investment. 'p' has been taken to be 7.98% and 'z' has been calculated to be 12.35%. d*, the depreciation rate, was calculated to be 0.05247, that is 5.25%, by the above method.

Apart from depreciation, we also require the effective interest rate to indicate the opportunity cost of funds. This is to be used in the case of all categories of capital expenditure, i.e. loans and advances, equity investment and own capital expenditure on the functional head.

The effective interest rates, calculated as interest payments as percentage of total borrowing by the concerned government (Centre/State), were obtained state-wise and year-wise from the interest and loans data given in the *Finance Accounts.*

The estimation methodology has certain important assumptions and limitations arising from those. In particular, the life of an asset is assumed to be fifty years. Estimated subsidies include inefficiency costs. These are integral to the public provision of private goods. Subsidies due to tax expenditures are not captured. Subsidies are calculated with respect to actual prices, even if these are administered, and not on the basis of market prices which would prevail if there were no regulated prices (Appendix 2).

4. Environmentally Positive Subsidies: Aggregate Volume

Subsidies having a bearing on environment in respect of the budgetary heads that have been identified earlier, amounted to Rs 5320 crore in 1994-95, Rs 6379 crore in 1995-96, and Rs 6471 crore in 1996-97 (Table 2.1). These figures, as percentage to GDP (at current market prices, 1993-94 base series) in the respective years, translate to 0.53, 0.54, and 0.47 per cent respectively. Out of these, subsidies on the following items, namely, irrigation (major, medium and minor), fertilisers, pesticides & chemicals and command area development are separated as pertaining to Group B. The subsidies which remain may be identified as unambiguously having a positive impact on environment. These have been referred to as Group A subsidies. It will be seen that Group A subsidies are a very small portion of the total subsidies having an environmental impact.

Table 2.1

Total Environment Related Subsidies of Centre and States: 1994-95, 1995-96, 1996-97

(Rs. Crore)

Groups/Heads	1994-95	1995-96	1996-97
Group A	333.89	664.76	624.18
Group B	4986.85	5714.27	5847.11
Irrigation (incl. CAD)	129.88	156.65	166.62
Fertilisers	4793.20	5369.11	5586.94
Pesticides and Chemicals	63.77	188.51	93.54
Total	5320.73	6379.03	6471.29
As % of GDP	0.53	0.54	0.47

Note: GDP at market prices are taken from National Accounts Statistics, C.S.O.,2001.

The all-India magnitudes of Group A subsidies, identified as having direct positive effect on environment, are given headwise in Table 2.2.

Table 2.2

Environment Promoting Subsidies (Group A) of Centre and States

(Rs. Crore)

Group A Heads	1994-95	1995-96	1996-97
Sewerage & Sanitation	42.00	46.49	17.10
Soil & Water Conservation	20.45	22.82	23.14
Fisheries	61.16	71.36	57.70
Forestry & Wildlife	-22.83	22.01	36.55
Agricultural Research & Education	52.20	56.68	56.96
Special Areas Development Programmes	0.62	263.19	224.66
Flood Control & Drainage	32.90	48.58	65.83
Non-Conventional Sources of Energy	147.34	133.63	142.24
Total	333.89	664.76	624.18

Note: (-) sign indicates that the sector generated surplus in the given year.

Detailed tables giving the different components required in the estimation of subsidies are given in Appendix 3.1 - 3.27. These include estimated costs comprising actuals and imputed components and receipts. The annualised cost of capital is obtained by applying the effective interest and depreciation rates to the relevant capital stock.

The division between Centre and States indicates that most of the Group A subsidies emanate from state budgets. The Centre has a higher share in some of the Group B subsidies (Table 2.3).

5. Inter-State Variations: An Analysis

Environment related subsidies emanate relatively more from the state budgets. Furthermore, subsidy estimates indicate huge disparities among states in the magnitude of environment promoting subsidies. In Table 2.4, aggregate and per capita subsidies for

Group A and Group B are given. The per capita subsidies indicate wide variations in the two groups.

Table 2.3

Group A and Group B Subsidies of Centre and States (1994-95 to 1996-97)

(Rs crore for agg. & Rs for per capita)

		1994-95	1995-96	1996-97
Group A Subsidies (aggregate)	Centre	333.89	664.76	624.18
	States	2831.96	2986.45	3596.76
Group B Subsidies (aggregate)	Centre	4986.85	5714.27	5847.11
	States	13718.96	15228.34	17484.72
Group A Subsidies (per capita)	Centre	3.64	7.24	6.80
	States	30.92	32.61	39.28
Group B Subsidies (per capita)	Centre	54.32	62.24	63.69
	States	149.81	166.29	190.93

Note: Per capita estimates for Centre are for the national population

It is useful to identify any notable patterns in the per capita subsidies given across states. In Table 2.5, the per capita subsidies are rearranged with respect to per capita GSDP and according to general and special category states to discern any noticeable patterns. At once, it is noticeable that per capita subsidies of both groups increase as the per capita GSDP of the state increases. This issue is further explored later in the chapter.

Other related information relating to subsidies are given in the Appendix tables as described below. Statewise subsidy volumes are given in Appendix 4.1 and the profile of recovery rates for environment promoting schemes is given in Appendix 4.2. The average recovery rates are observed to be low. The north eastern states like Mizoram, Assam and Sikkim and also the hilly state of Jammu and Kashmir show extremely low rates

Table 2.4

Environmental Subsidies: Inter State Comparison (1996-97)

State	Group A Subsidies		Group B Subsidies	
	Aggregate (Rs Crore)	Per Capita (Rs)	Aggregate (Rs Crore)	Per Capita (Rs)
Andhra Pradesh	167.69	23.44	1879.12	262.63
Arunachal Pradesh	23.43	241.16	22.45	231.08
Assam	163.22	67.18	178.31	73.39
Bihar	201.48	21.69	946.60	101.89
Delhi	37.17	34.16	6.30	5.79
Goa	12.06	92.04	52.43	400.34
Gujarat	191.43	42.76	1746.72	390.18
Haryana	81.51	45.25	532.43	295.54
Himachal Pradesh	46.79	82.33	56.91	100.15
Jammu & Kashmir	97.61	115.36	96.32	113.84
Karnataka	209.67	43.11	1482.84	304.86
Kerala	198.60	63.91	322.47	103.77
Madhya Pradesh	416.81	57.67	1167.80	161.56
Maharashtra	551.17	64.58	3312.85	388.14
Manipur	41.07	199.34	63.46	307.99
Meghalaya	27.75	139.40	10.60	53.22
Mizoram	14.86	191.58	2.84	36.62
Nagaland	21.80	159.75	8.47	62.04
Orissa	137.40	40.31	672.69	197.37
Punjab	97.25	44.25	591.52	269.17
Rajasthan	117.22	24.30	1128.40	233.96
Sikkim	12.31	269.71	3.16	69.20
Tamil Nadu	152.28	25.54	431.03	72.28
Tripura	26.09	84.36	30.22	97.72
Uttar Pradesh	377.08	24.76	2298.63	150.91
West Bengal	173.02	23.50	440.14	59.79
Total	3596.77	39.28	17484.71	190.93

Appendix 4.3 gives yearwise subsidies as a proportion of total revenue receipts of the state. This is to identify any correlation between the income of the state and its propensity to spend on environment friendly activities. A comparison of per capita SDP with per capita environment promoting subsidies (Table 2.5) shows that richer states like Maharashtra, Gujarat, Andhra Pradesh, Haryana, etc. have larger per capita subsidies. This implies that with rise in income, investment in these subsidies increases more than proportionately. That may indicate that environmental consciousness is directly linked to the level of development

Table 2.5

Per Capita Environment Related Subsidies

(Rs.)

Average GSDP Per Capita	**States**	**Per Capita Environment-Related Subsidies (Avg. 94-95 to 96-97)**	
	General Category	Group A	Group B
4753	Bihar	20.09	96.47
6615	Orissa	37.47	175.7
6763	Uttar Pradesh	20.01	138.8
7925	Madhya Pradesh	48.44	149.01
8337	Rajasthan	33.00	209.29
9422	West Bengal	20.26	52.68
9484	Himachal Pradesh	79.70	96.28
10292	Andhra Pradesh	18.03	215.84
10308	Kerala	53.26	97.24
10575	Karnataka	37.34	260.91
11535	Tamil Nadu	22.93	66.25
14998	Gujarat	39.24	339.46
15934	Haryana	40.64	327.28
17438	Maharashtra	50.07	326.71
18392	Punjab	39.76	226.82
21609	Goa	83.83	334.06
	Special Category		
5593	Tripura	78.10	92.69
7551	Assam	65.85	70.14
7934	Manipur	158.24	292.22
8915	Meghalaya	129.75	45.04
10201	Mizoram	189.80	39.04
10352	Sikkim	209.79	64.18
11861	Nagaland	123.46	51.04
11871	Arunachal Pradesh	230.76	210.56
24257	Delhi	22.19	4.76

States with very poor allocation for environment promoting subsidies, are those of Mizoram, Sikkim, Nagaland, Arunachal Pradesh and other such hilly north-eastern states.

In Appendix 4.4 environment related subsidies as a proportion of total revenue expenditure are given. This proportion may partly reflect the priority attached to the environment, although a full examination is not possible without the entire breakup of expenditure into different sectors. Here we find that states like Andhra Pradesh, Gujarat and Maharashtra, have high subsidy to expenditure ratios. States of Bihar and Orissa also show high values.

As a corollary to this exercise, in Appendix 4.5 revenue expenditure on environment friendly activities as a proportion of total revenue expenditure is given. This was done yearwise and then the averages of both revenue expenditure on environment friendly activities and total revenue expenditure were taken and the proportion was calculated, as given in Appendix 4.6. These proportions, when arranged in ascending order, provide a comparison across states regarding their concern and need for environment protection and promotion.

Appendix 4.6 does not point to any definite groups of states which can be clubbed together as alike in this respect, with substantial differences in the relative proportions compared to the other groups. We find that Gujarat, Maharashtra and Uttar Pradesh are the three top ranking states.

In Appendix 4.7, environment related subsidy per capita for different states for the three years are given. Some interesting results are indicated. Not considering Delhi, West Bengal has the lowest per capita subsidy of Rs 71.78. Tamil Nadu recorded a per capita average subsidy of Rs 89 for these three years which is only a little more than that of West Bengal. As to why per capita subsidy is so low is difficult to explain. Tamil Nadu's population density is quite high (over 450 per square kilometre). But it may not be high enough to explain its low subsidy per capita. For example, Kerala, which has a population density of nearly 800 per square kilometre, records a per capita subsidy of more than 150 rupees.

Among the states that have a sizeable population, Maharashtra stands out, with a substantial subsidy per capita of over 375 rupees. Other states which show relatively higher figures are usually states with low population density which need to preserve their forests and agriculture, such as the state of Goa or some of the north-eastern states like Arunachal Pradesh and Manipur. Rich states such as Gujarat and Haryana also show high levels.

Appendix 4.8 contains the ranking of states according to their average subsidy as a proportion of total revenue expenditure. This gives us an indication as to how much expenditure is targeted for these subsidies. Evidently, three of the underdeveloped north-eastern states, Sikkim, Nagaland and Mizoram, occupy the lowest rungs. Manipur, among the special category states however, shows a fairly high subsidy proportion of more than 15 per cent.

At the upper end, Gujarat and Maharashtra have the highest proportion of subsidy to total revenue expenditure. They are closely followed by states like Karnataka and Orissa. States with extensive agricultural activities tend to have high subsidies relative to total expenditure. In Appendix 4.9, statewise per capita revenue expenditure on environment promoting budgetary heads is given.

For further analysis, general and special category states were separated. Per capita subsidies and other allied variables were plotted against per capita income to identify any noticeable patterns.

Four sets of graphs were constructed. In the first, Appendix 5.1, per capita subsidy was plotted against GSDP per capita. A positive correlation can be seen in the case of general category states. Jammu & Kashmir and Delhi were not included in any of the groups as these are special states and do not conform to the trend. This positive relationship is more pronounced when per capita revenue expenditure on environment promoting schemes is seen against per capita income as shown in Appendix 5.2 indicating that the propensity of a state to invest in environmental subsidies depends largely on the financial condition of the state. Leaving out a few outliers, it is indicated that expenditure on environmentally positive subsidies *does* have a direct relation to the income of the state, when like states are grouped together. In Appendix 5.3, revenue expenditure on environmental related items as percentage of total revenue expenditure (average of three years) is plotted against GSDP per capita for all states, and separately for the north-eastern states and other states. In Appendix 5.4, subsidies on environment related items as proportion of total revenue expenditure (average of three years) are plotted. These percentages show no visible relationship with per capita GSDP, indicating that factors other than income are responsible for the inter-state variations in subsidies.

6. Conclusions:

The Indian scenario in paying attention to environment today seems mixed. We have states investing in agricultural input subsidies for betterment of the agricultural sector, which may potentially harm agriculture itself through a degeneration of the environment on the other hand. We also find that adequate environmental protection is missing in states where they are most desirable. The environmental problems of the country today call for appropriate and reliable data generation, which would help in fully analysing the existing scenario and in formulating related policies.

Some of the main findings are summarised below:

i. Subsidies identified as having a bearing on environment account for less than one per cent of the GDP, Centre and States considered together; of these, subsidies having a clear positive impact on environment are only a small fraction.

ii. Division of subsidies between centre and states shows that environment-related (ER) subsidies emanate relatively more from the state budgets.

iii. Centre has a higher share in some of the Group B subsidies.

iv. A profile of recovery rates for ER subsidies across states shows that the north-eastern states like Mizoram, Assam and Sikkim and also the hilly state of Jammu and Kashmir have extremely low recovery rates.

v. Inter-State comparisons of per capita ER subsidies broadly indicate that:

   a. per capita subsidy is higher for states with higher per capita incomes; and

   b. a substantial share of ER subsidies pertains to irrigation.

vi. A positive relationship is seen when per capita revenue expenditure on environment promoting schemes is plotted against per capita income of the state indicating that the propensity of a state to invest in environmental subsidies depends largely on financial condition of the state.

vii. Subsidies relating to major and medium irrigation, minor irrigation and soil and water conservation had the largest share in ER subsidies for most states.

IDENTIFYING ENVIRONMENTALLY PERVERSE AND POSITIVE SUBSIDIES: CASE OF AGRICULTURE 3

1. Introduction

The issue of subsidies in general and agricultural subsidies in particular has been in debate in India, since early nineties. Some of the reasons that have been advanced in support of farm subsidies are: food security, income redistribution, stability in food prices and encouragement to use new farming methods. Farm subsidies have, however, put enormous strain on government budgets. In addition to straining budgets, subsidies distort prices of agricultural inputs and thereby affect levels of input use. This has an effect on the availability of inputs and resources used in agriculture. When supply of inputs is constrained by natural or other factors, the sustainability of agricultural development may be affected. Excessive and inefficient use of agricultural inputs such as fertilisers, water and pesticides is also reported to have detrimental consequences for the environment and human health and welfare.

In this chapter, we provide an analytical framework to identify the environmental impact of subsidies to agricultural inputs and analyse its implications for the sustainability of agriculture. To deal with this topic we have focussed on fertiliser, irrigation and power. Subsidies to these inputs are given in different forms and sizes. A number of studies have attempted to measure the magnitude of these subsidies. Depending on the definition of subsidy used, the magnitudes of subsidy have varied. However, there exists one commonality between the policy implications of these studies. All the studies bring out that in addition to straining budgets, subsidies to these inputs distort their prices and thereby affect levels of their use, which have wide ranging implications for the environment and the economy. Here, we bring out the environmental implications of the subsidy induced demand of these inputs in agriculture.

2. Agricultural Subsidies and the Environment

Agriculture has a significant impact on environment, particularly on soil, water, biodiversity and air. The specific impact depends, among other factors, on the type and quantity of crops produced, the farming practices employed, the level and mix of inputs such as fertilisers and pesticides applied, irrigation methods, and site specific environmental conditions. Farmers will be concerned about the environmental performance of the agricultural sector if they are faced with adequate incentives to include the environmental costs and benefits of their activities in their production decisions. Markets do not penalise farmers for harming the environment, nor offer rewards for avoiding or reducing harmful effects. Government pricing policies of both agricultural inputs and outputs have encouraged a commodity mix narrower than would be the case if these policies were not in place, and have promoted high levels of water, fertiliser and chemical use. This, in turn, has exacerbated environmental pollution, especially soil erosion, and surface and groundwater pollution. The mechanism is a form of derived demand for inputs (Harold and Runge, 1993).

There are three main challenges involved in identifying/evaluating the environmental impact of both environmentally perverse and environment supporting subsidies:

- The impact is likely to differ from one environmental situation to another, because the sensitivity of an ecosystem will differ according to the specific situation, and most subsidy measures will extend beyond a single ecosystem. Often environmental degradation is visible after a long period of time, so these long-term impacts have to be taken into consideration while analysing the environmental impacts.
- Human behaviour will be affected not only by the particular subsidy in question, but also by all the other government programmes that affect a given individual. There may be multiple subsidy programmes, perhaps with conflicting objectives, that are relevant.
- Some subsidy programmes may make payments that are inconsistent with the programme's own goals. For example, the programme may have outlived the life span envisaged by its designers, or it may apply to "fringe" areas where circumstances do not match those which its designers foresaw (Barg, 1996).

3. Perverse Subsidies and the Environment

Subsidies that encourage human action causing damage to the environment are perverse because they create incentives to behave in ways which decrease social welfare. In order to analyse such situations, one must first examine the environmental problems that arise from the human activity that is encouraged by these subsidies. Thus, one must come at the problem from both directions: *define the subsidy and how it affects the human behaviour, and define the environmental situation and how it is affected by the subsidy induced behaviour*. Panayotou's list of *Economic manifestations of Environmental Degradation* is a useful starting point for analysing such situations. This is presented in Box 3.1.

Box 3.1. Representative List of Economic Manifestations of Environmental Degradation

- Overuse, waste and inefficiency co-exist with growing resource scarcity (shortages).
- An increasingly scarce resource is put to inferior, low-return, and unsustainable uses, even though superior, high-return and sustainable uses exist.
- A renewable resource, capable of sustainable management is exploited as an extractive resource (i.e. it is mined).
- A resource is put to a single use, when multiple uses would generate larger net benefits.
- Investments in the protection and enhancement of the resource base are not undertaken, even though they would generate a positive net present value by increasing productivity and enhancing sustainability.
- A larger amount of effort and cost is incurred, when a smaller amount of effort and cost would have generated a higher level of output, more profit and less damage to the resource.
- Local communities and tribal and other groups, such as women, are displaced and deprived of their customary rights of access to resources, regardless of the fact that, because of their specialised knowledge, tradition and self-interest, they may be the most cost-effective managers of those resources.
- Public projects are undertaken that do not make adequate provision for, or generate sufficient benefits to, compensate all those affected (including the environment) to a level where they are decidedly better off "with" than "without" the project.
- Failure to recycle resources and by-products, when recycling would generate both economic and environmental benefits.
- Unique sites and habitats are lost, and animal and plant species go extinct without compelling economic reasons which counter the value of uniqueness and diversity and the cost of irreversible loss.

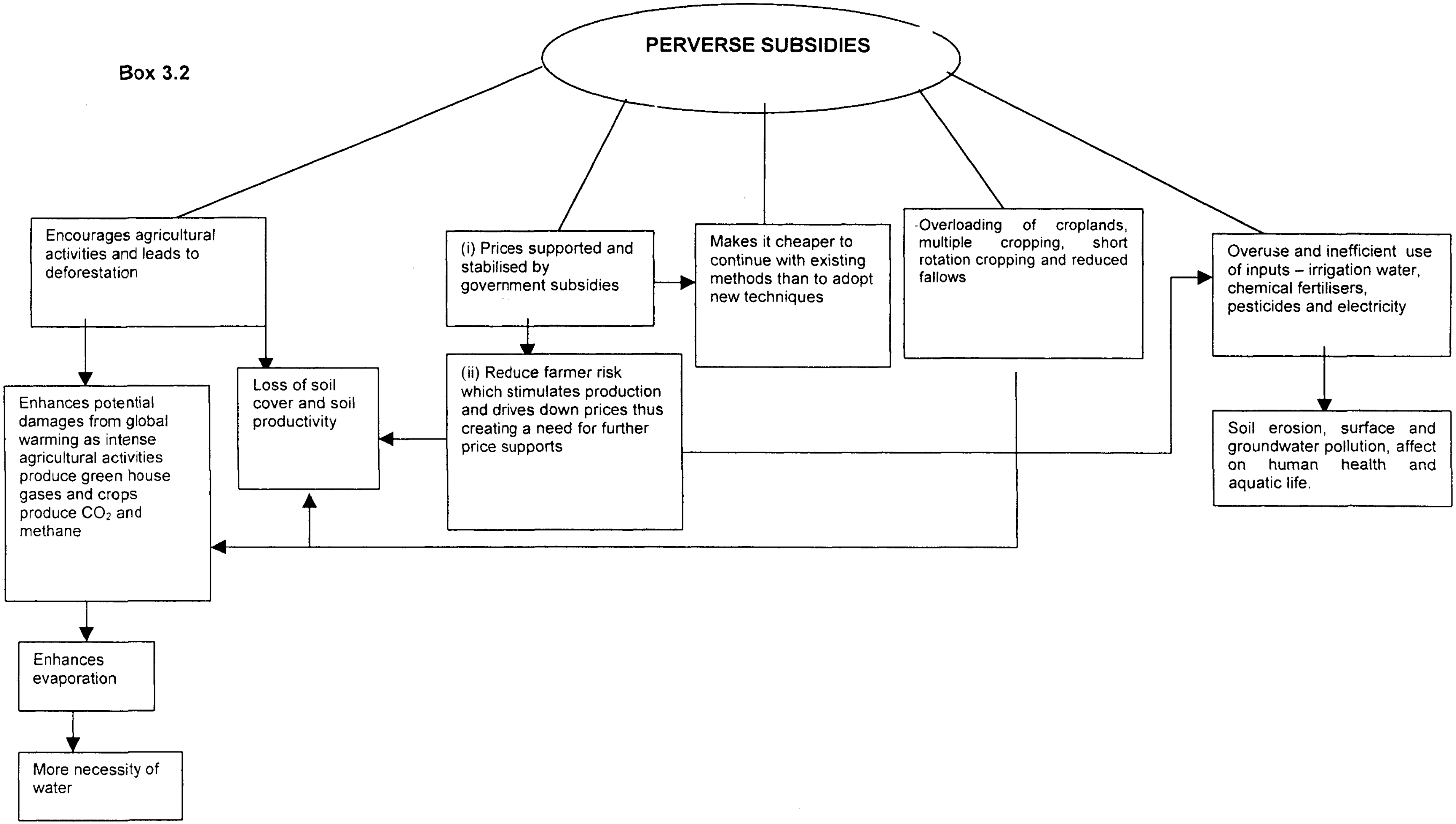
Source: Barg, 1996.

As long as agricultural subsidies nurture hidden costs in the form of environmental damage, they may be considered as perverse subsidies. Box 3.2 illustrates broadly the ways in which ill-targeted subsidies in agriculture could be perverse.

4. Impacts of Environmental Stressors and Indicators of Environmental Stress

In order to evaluate the impact of subsidies to agricultural inputs it is important to identify their potential impacts on environmental resources, and human health and welfare. The chemical and/or physical changes in the environment associated with an activity or source - in this case agricultural inputs - are described as stressors, which is a term used to denote the types and levels of pollutant emissions or habitat alterations. Through the media of air, land and water, such environmental changes and pollutants ultimately affect resources, people, wildlife and plants (Table 3.1). The impacts may have far reaching effects or may affect the receptor on a smaller scale. They can be on-site (localized) or off-site (regional or even global) impacts, physical (e.g. loss of species diversity) and chemical effects (such as diseases), socio-economic impacts (e.g. loss of income, resettlement of people or land abandonment) or near-term and long-term impacts.

Box 3.2


PERVERSE SUBSIDIES
Encourages agricultural activities and leads to deforestation
(i) Prices supported and stabilised by government subsidies
Makes it cheaper to continue with existing methods than to adopt new techniques
-Overloading of croplands, multiple cropping, short rotation cropping and reduced fallows
Overuse and inefficient use of inputs – irrigation water, chemical fertilisers, pesticides and electricity
Loss of soil cover and soil productivity
(ii) Reduce farmer risk which stimulates production and drives down prices thus creating a need for further price supports
Soil erosion, surface and groundwater pollution, affect on human health and aquatic life.
Enhances potential damages from global warming as intense agricultural activities produce green house gases and crops produce CO_2 and methane
Enhances evaporation
More necessity of water

5. Environmental Impacts of Subsidies to Agricultural Inputs: Evidence from Literature

In practice, many subsidies are not only excessive but ill targeted and also tend to become open ended and continued long after they have served their purpose. Recently it has been increasingly recognised that many subsidies directed towards agriculture impose a high cost on society through their adverse impact on environmental resources. In this context, this section reviews the existing literature on the subject with an objective to examine the environmental impact of the subsidies to fertilisers, surface irrigation, pesticides and power and its implications for the sustainability of natural resources and agriculture.

5.1 Power Subsidy: Impact on Groundwater Depletion

It is generally perceived that reducing energy consumption implies reducing production. However Singh (1999) reports that this is a misconception. His study cites Mitra (1992) who found that the linkage between energy consumption and economic growth has been broken decisively by the developed countries after the oil crises, which broke out in the early seventies. Middle income and lower middle income countries too have shown that efficiency of energy use can significantly reduce the consumption of energy without impairing economic growth targets. However the low income countries, among them India most prominently, have remained stuck with high energy intensity in their economic development processes and profiles. The persistent neglect of the energy conservation in agriculture is a glaring example of this. The irrational pricing policy of electricity results in the inefficient use of electricity on the one hand and inefficient use of water on the other.

Myers, et.al. (1998) notes that irrigation subsidies encourage wasteful use of scarce water worldwide. Power subsidies too, encourage withdrawal of groundwater for agricultural use, leading to a decline in the water table. These have implications for both the availability of scarce water resource and the environmental problems entailed by its overuse and wastage, namely groundwater depletion, and soil depletion which have serious impact on agriculture

Sidhu and Dhillon (1997), on the basis of a study conducted in Punjab show that the low rates of electricity and the flat rate system of charging have induced farmers to shift to tubewell irrigation, water intensive crops and over irrigation which have resulted in

Table 3.1. Taxonomy for Evaluating Potential Impacts of Environmental Stressors

	Effects Category											
	Environmental Resources							Human Health		Human Welfare		
Potential Burdens to Water												
	Ground Water Contaminatio n	Surfacewater Contaminatio n	Groun d Water Level	Coastal, Marine & Freshwate r Ecosyste ms	Terrestrial Ecosyste ms	Biodiversity /Endangered Species	Sedimentati on	Mortality	Morbidity	Material loss	Aesthetic s	Resource Use
Stressor	✓	✓		✓		✓			✓			✓
Pesticides	✓	✓		✓	✓	✓		✓	✓			✓
Irrigation (surface)	✓	✓	✓				✓			✓	✓	✓
Electricity			✓								✓	✓
Potential Burdens to Land												
	Contaminatio n	Waterlogging	Salinity	Erosion	Terrestrial Ecosyste ms	Biodiversity /Endangered Species	Nutrient Leaching	Mortality	Morbidity	Material loss	Aesthetic s	Resource Use
Fertilisers	✓				✓							✓
Pesticides	✓				✓	✓			✓			✓
Irrigation (surface)		✓	✓	✓	✓		✓			✓		✓
Electricity				✓	✓							✓

Stressor	Effects Category											
	Environmental Resources							Human Health		Human Welfare		
<u>Potential Burdens to Air</u>												
					Terrestrial Ecosystems			Mortality	Morbidity	Material loss	Aesthetics	Resource Use
Pesticides					✓			✓	✓			

Resource Use : Changes in the productivity or value of commercial, subsistence or recreational uses of such natural resources as forests (e.g., for timber), agricultural lands (e.g., for crops), fisheries (e.g., for subsistence diets) or wildlife (e.g., for ecotourism).

Coastal and Other Marine Ecosystems : Includes reef, fishery, and other biological resources in saline water.

Freshwater Ecosystems : Includes wetlands, watersheds, and other biological resources in fresh water (sweetwater).

Biodiversity/Endangered Species : Impacts on the diversity of flora and fauna, species that are endemic or unique, and species habitats and corridors (e.g., flyways for birds)

Terrestrial Ecosystems : Flora and fauna, minerals, soil, forest or grassland habitat.

a sharp decline in the groundwater level and consequently, the electricity requirement for drawing groundwater is increasing year after year. The groundwater level has declined in 86 per cent of the area of the State. The decline was more than 5 metres in 29 per cent of the area implying 7 to 10 per cent increase in electricity demand. Further, there was a sharp shift from dry crops to water intensive crops. For instance, the area under rice which is a irrigation intensive crop increased from 292 thousand hectares in 1970-71 to 2276 thousand hectares in 1994-95. The marginal lands too were put under the water intensive crops. The study also reveals that the zero marginal cost of irrigation due to the rate system of charges for electricity has induced the farmers to over irrigate. Only 54.7 per cent of the farmers applied the required number of irrigations, the remaining over irrigated the rice crop to various degree.

Subsidy on electricity has affected the efficiency of irrigation systems too. A study conducted by the Punjab Agricultural University (1997) on the operational efficiency of electricity operated tubewells found that 33 per cent tubewells were operating at 50 per cent of efficiency, 21 per cent were at 40-50 per cent level of efficiency and the remaining were operating at less than 45 per cent level of efficiency.

Joshi (1997) reports that the water table in the good aquifer regions of Haryana has declined ranging between 1 and 83 cm during the last one decade posing serious threat to the agricultural economy of Haryana.

In coastal regions, fresh groundwater supplies are vulnerable to contamination by salt water intrusion. Overdraft of these fresh water zones causes salt water intrusions. Katar Singh (1999) shows that the groundwater table has gone down drastically in many areas of the country such as Mehsana district in north Gujarat and Coimbatore district in west Tamil Nadu. It is estimated that in Mehsana district, water table has been falling at the rate of 5-8 metres annually and that some 2,000 wells dry up every year. In the coastal areas of Gujarat, excessive extraction has depleted the groundwater aquifers and the vacuum so created has been filled in by intrusion of sea water – a phenomenon called salinity ingress. It is estimated that salinity ingress is increasing at an alarming rate of one-half to one km a year, along 60 per cent of the 1,100 km long Saurashtra coast. The salinity ingress has rendered groundwater in those areas unfit for both domestic and agricultural uses and has adversely affected crop yields. Singh fears that " sometimes, these effects are slow in coming, but by the time they are recognized it may be too late to correct the damage."

5.2 *Irrigation Subsidy: Impact on Waterlogging, Salinity and Soil Erosion*

Increase in soil salinity is recognised worldwide as a major deprecating factor in agricultural growth. Myers (1998) notes that world-wide, 454,000 sq. km of the 2.8 million sq. km. of land is salinized which is enough to reduce crop yields, with crop losses worth almost $11 billion per year. The study also notes that the problem derives primarily from subsidies that encourage careless and prodigal use of seemingly plentiful water supplies. Government subsidies encourage wasteful use of water, and eliminate any incentive to use it sparingly. Mexico loses a million metric tons of grain a year because of soil salinity, enough to feed five million people and Pakistan today spends more on pumping out salt-laden water than on irrigation.

Joshi and Jha (1992) show that in the long run, waterlogging and salinity lead to land abandonment, while in the short-term and medium-term, there are adverse productivity impacts. Presently, salinity affects productivity in about 86 million hectares of the world's irrigated land. At least 2 to 3 lakh hectares of irrigated land are lost every year due to salinisation and waterlogging. In developed and developing countries, salinity and waterlogging together are responsible for the decline of about 1.1 million tons of grain output each year.

India, being predominantly an agriculture based economy and with many inefficiencies in its irrigation subsidy policies, is no exception to this problem. Myers (1999) notes that in India 100,000 sq. km out of 420,000 square km. of irrigated croplands have been lost to cultivation through waterlogging, and 70,000 square km. are affected by salinization. It is estimated that Indian farmers could cut back on irrigation water use by 15 percent without reducing crop yields simply by eliminating over-watering. Marothia (1997) shows that subsidized canal irrigation and subsidized electricity (in some cases free) for tubewells, remunerative output price support, availability of HYV seeds and higher returns encouraged the farmers to opt for water intensive crops. Nearly 1/4th of the cultivable command area under all canal projects in India is suffering from waterlogging and soil salinity. This has adversely affected the crop productivity and restricted the choice of crops. As precise statistical data are not yet available as to the amount of irrigated lands that have fallen into disuse because of waterlogging and salinity, these concerns are inadequately addressed in most of the irrigation investment decisions.

The study by Joshi and Jha (1992) focuses primarily on the problem of soil alkalinity and waterlogging in the Sharda Canal Command area and attempts to measure its impact at the farm level in terms of resource use, productivity and profitability of crop production. Four villages in the Gauriganj block were chosen for the study covering the 1985-86 cropping year. The study finds that overuse of canal irrigation and underuse of groundwater has disturbed the water balance of the area causing waterlogging and increase in salinisation in the command area. The reason for under-exploitation of rather good quality groundwater is low water rate on canal irrigation. It has been shown that the cost of tubewell irrigation is much higher (Rs. 825 per hectare for paddy) as compared to the rate of canal water tariff (Rs. 143.26 per hectare for paddy). Such a wide difference in the cost of irrigation has led the farmers to discontinue the use of groundwater, resulting in an increase in water table and soil alkalinity.

The study further notes that crop choices are severely restricted under degraded soil conditions. Under salt affected and waterlogged soils, crops like pulses, sugarcane, potato and a number of other crops are not grown. In such situations intensity of land use goes down and in the extreme such problems lead to abandonment of cultivation. Thus land degradation aggravates land scarcity. Results of the study on productivity and profitability of crop production were far more revealing. Though in farmers' perceptions, yields of paddy and wheat halved in about eight years time due to increasing soil degradation, estimates of the study indicated that paddy and wheat yields went down by more than 51 per cent and 56 per cent respectively on salt-affected soils. For wheat, the net income fell by 92 per cent. The unit cost of production rose by 59 to 61 per cent for paddy and by 85 per cent for wheat when cultivation is extended on salt affected soils. The study concludes that with the same level of resources as used on normal soils, gross output would decline by 63-64 per cent on salt affected or waterlogged soils. The study concludes that underpricing in favour of canal irrigation is, by and large, responsible for such a situation. Joshi (1994), based on primary data reports that the crop productivity in Western Yamuna and Bhakra Canal Command showed a declining trend in comparison to normal soils.

Sharma, Parshad and Gajja (1997), finds that in Haryana about 70 per cent of the geographical area is facing the problem of rising water table due to the dominance of canal irrigation, lack of adequate drainage and low extraction of ground water. Gangwar and Toorn (1987) put the economic loss due to rising and poor quality of water in Haryana at Rs. 26.8 crores and anticipates it to rise to a level of Rs.71.9 crores in 2000. The State is also salt affected. Singh (1984), estimates that an area of 450 thousand hectares under salinity/alkalinity and waterlogging. More severely affected districts are Karnal, Kurukshetra, Jind, Hisar, Sonipat and Rohtak.

In the Central-Southern districts of Jind, Hisar, Sirsa and Bhiwani, where most of the area is canal irrigated , the water table rose at a fast rate during 1974-91 (0.7 metre in Rohtak to 6.5 metre in Sirsa district) leading to waterlogging and secondary salinity. Moreover, these areas are underlain by brackish water. So waterlogging is assuming gigantic proportions in various canal command areas. The worst affected districts are Rohtak, Jind, Hisar and Sirsa.

To sum up, the widespread and repeated use of irrigation water without provision for adequate drainage, and crop intensification in favour of high water requirement crops without utilising the groundwater has resulted in rapid rise in watertable in the areas with poor quality groundwater, leading to the problem of waterlogging and salinity. On the other hand, the regions endowed with good quality groundwater are being over exploited without maintaining the water level at a reasonable depth. According to Karwasra, Singh and Singh (1997) both the situations are undesirable for the sustainability of agriculture. Unplanned intensive irrigation also lead to infestation of weeds and inception of water borne diseases.

5.3 *Fertiliser Subsidy: Impact on Soil Productivity, and Groundwater and Surface Water Contamination*

Three main fertilisers used in agriculture are urea (N), di-ammonium phosphate (DAP) and Potash (K). Of these the production of urea is under the retention price scheme. There is a flat rate subsidy on DAP. Potash, which is mainly imported, also has a flat rate subsidy. One of the main purposes of retention price scheme is to develop the urea industry in the country. Every individual plant is assured a fixed rate of return. Hence the retention prices are fixed for each individual plant. The subsidy on urea is the difference between the retention price (adjusted for freight etc.) and the price that the farmer pays. According to Gulati and Narayanan (2000), the fertiliser subsidy bill in 1988-89 amounted to Rs. 112 billion. In the eighties there was an unprecedented growth in the fertiliser subsidy in India. Parikh and Suryanarayana (1992) show that the rate of fertiliser subsidy on domestic production has increased from Rs. 565.72 per tonne to Rs. 1383.33 per tonne in 1987-88.

Application of fertilisers and pesticides is essential in order to increase food production and achieve the targeted agricultural production. However, studies reveal that indiscriminate use of fertilisers have proved detrimental. According to a study Mehta (1971), in Gujarat region, nitrogen leaching for 90 cm. soil depth under 564 mm. rainfall was 14kg/ha. out of 180kg/ha. N applied. In a rice field near Delhi, loss of 14.3 kg/ha. was reported from an application of 120kg/ha (Mahalanobis, 1971). Handa (1987) found that the main cause of groundwater pollution is indiscriminate and higher dose of fertilisers and pesticides. The study also finds that the nitrate content in the soil sample of the States where lower doses of fertilisers are used is considerably low as compared to the States where per hectare use of fertiliser is higher. It must be noted the soil health has direct impact on crop yield.

According to Sidhu and Byerlee (1992), in relatively more developed districts of Punjab, such as Ludhiana, fertiliser use has already exceeded the recommended dose at least for nitrogen. Hence marginal contribution of fertiliser to yield increases is predicted to be substantially lower in future. The study computed the land, labour and fertiliser productivity for the years 1975 and 1985 for various states of India and expressed them as percentages of Punjab figures. The results show a decline in fertiliser productivity in Punjab, Haryana, Uttar Pradesh, Madhya Pradesh and Rajasthan due to application of increasing amounts of fertilisers to maintain current levels of yield.

Sah and Shah (1992) find that in irrigated areas of Gujarat where fertiliser use is widespread and has reached 1.5 times or more than the recommended amounts, the issue of fertiliser use efficiency has become increasingly important. The analysis based on a sample of 330 farmers located in 42 villages of 5 important soil-crop zones in Gujarat, finds that excessive use of fertilisers is widespread; only one out of 5 farmers who had received soil test recommendations, used fertilisers as recommended. Farmers' inability to visualise the effect of nutrient balance on crop output distorts their perceptions about yield response, resulting in overuse.

Singh, Singh and Kundu (1997) analyses the environmental consequences of the rice-wheat cropping system in Haryana. The study finds that increasing fertiliser use has led to diminishing marginal gains to nutrient ratio from 14.65 to 9.36 for rice and from 21.5 to 8.67 for wheat between 1970-75 and 1990-94.

Nagaraj, Khan and Karnool (1998) examine the resource use efficiency in cultivation of various crops under different cropping systems in Tungabhadra Command Area (Karnataka). The results of the study show that the regression coefficients for manure and fertilisers are negative and non-significant in production of paddy indicating a negative influence on the gross returns from paddy and that the input is used in excess of requirements.

According to Joshi (1997) adoption of nutrient responsive high-yielding varieties, and application of inorganic fertilisers without soil test and widespread application with wrong nutrient balance have resulted in nutrient imbalance of the soil in many parts of the country. As a result, the actual productivity from using inorganic fertilisers was much lower than that of the potential. Nearly 70 per cent of the fertiliser was applied to rice and wheat in Haryana. Tomer and Khatkar find that the farmers in Haryana were applying overdoses of fertiliser, particularly of nitrogenous fertiliser in most of the crops. The recommended ratio of N, P, K (4:2:1), is not being maintained due to subsidies in favour of nitrogenous fertilisers. Some economists argue that soil nutrient related problems were due to imbalance of subsidies for the major nutrients. Nutrient deficiency and loss of organic matter were among other important reasons for declining productivity of rice and wheat.

Ray (1998) observed that although, use of fertilisers, pesticides and water are unavoidable for achieving the targeted agricultural growth, indiscriminate use of these inputs creates environmental problems. The study analyses fertiliser consumption data for Andhra Pradesh, Punjab, Haryana, Tamil Nadu, Bihar, Madhya Pradesh, Orissa, and Rajasthan from 1981 to 1995 and concludes that

1. due to use of more and more fertilisers the return from per unit of fertiliser was decreasing for both the crops and in almost all States;

2. the return from per kg. of fertiliser is highest in less developed States where the rate of use of fertilisers is substantially lower as compared to the States where a high dose of fertiliser has been used; and

3. due to the use of higher dose of fertilisers and pesticides, the pollution of soil and groundwater is more and as a consequence, the marginal physical productivity of fertilisers declined significantly.

The study notes that increasing trends in bringing land under rice and wheat and other profitable crops and applying higher doses of fertilisers are not likely to change in the near future. Therefore, efforts be made to ensure judicial use of fertilisers and pesticides so that only a small portion is left unutilized which reaches the soil and groundwater.

Joshi (1997) reports that degradation of natural resources has undermined production capacity in different regions. Therefore future productivity levels and growth in production will have to rely on availability of resource friendly technologies and practices.

Jikun Huang and Scott Rozelle (1995) in an analysis of the slower growth of grain yields in China in the late 1980s, observe that the intensification of China's agricultural practices and other rural activities appear to have caused an increase in environmental stress that created a drag yield growth.

5.4 Environmental Impact of Indiscriminate Use of Pesticides

Deep concern is expressed about the excessive use of pesticides in developing countries, which is reported to have led to environmental degradation. Jumanah Farah (1994) shows that some pesticides persist longer than others or break down to even more toxic components, extending the time span in which they could contaminate agricultural crops, surface and underground water, and surface water bodies. Pesticides affect not only the location of their application but also the ecosystems far removed due to their mobility in air and water. Further, pesticides usually kill pests and their natural enemies alike. Pests are also very adept at developing resistance against the chemical pesticides intended to control them. Thus pesticide use initiated to suppress pests may lead to greater pest outbreaks. The study notes that towards the late 80s, with the growth of herbicide use, at least 48 weed species had gained resistance to chemicals. Another source estimates that from 1930 to 1960, the number of resistant anthropod species (insects, mites, ticks) rose from just 6 to 137, an average increase of 4 resistant species per year. In the period of 1960-80, on an average 13 species per year are reported to have gained resistance to chemical pesticides. It was estimated that in 1990 approximately 504 insect and mite species had acquired resistance to pesticides in use.

The wipe out of essential predatory insects due to excessive and uncontrolled pesticide treatments has created new pests. For instance, in cotton production in the Canete Valley in Peru, spraying to control the tobacco budworm led to the rapid build-up of the cotton aphid. As chemical treatment intensified to counteract this resistance build-up, other pests developed because their natural predators were eliminated. In Mexico, the tobacco budworm developed resistance to all known pesticides and caused the cotton planted area to drop from more than 280,000 ha to a mere 400 ha in the 60s. Similarly, in Nicaragua, 15 years of heavy insecticide use on cotton were followed by 4 years in which yields fell by 30per cent.

Pesticide-related poisoning could occur in human beings as a result of excessive exposure to pesticides, through inhalation or on consuming heavily or untimely pesticide treated crops. Karwasra, Singh and Singh (1997) assess the impact of agricultural development on nature and extent of resource degradation in Haryana. They observe that in the central-southern districts, intensive canal irrigation has led to waterlogging and increase in salinity and this has encouraged profuse growth of weeds and insect-pests.

To control such infestation and to propel any further harvest, intensive chemical control measures will have to be employed. The study notes that the direct ill-effects of farm chemicals have started showing its presence in the form of nitrate concentration in water and pesticides residue in different food items. Bhatnagar and Thakur (1998) show that in Haryana from 1966 to 1993 both consumption and coverage of area by pesticides has shown accelerating growth rates. Consumption of pesticides has grown at a higher rate than the growth in areas covered by the use of pesticides.

Farah (1994) notes that the pesticide users are hardly aware of the negative externalities on the environment. In the absence of government intervention through regulations and taxation, they tend to overuse pesticides and this tendency is further exacerbated due to international and national institutional economic policies which directly or indirectly lead to farmers applying more pesticides than they would otherwise.

According to Joshi (1997) pesticide consumption in Indian agriculture has increased manifold during the last three decades. Five states, namely, Andhra Pradesh, Gujarat, Maharashtra, Punjab and Tamil Nadu, accounted for more than 90 per cent of the pesticide use in the country. Although the average consumption of pesticide in India is low, 33 grams/hect., indiscriminate use of pesticide in some pockets is causing several environmental and health problems. Farah (1994) reports that, during the 1989/90 season, $27 million worth of pesticides were used in the district of Guntur in the state of Andhra Pradesh. With an average overuse of 20 per cent, $5.4 million of pesticides were wasted, which could have been avoided through better pest management. The yield losses due to pest resistance were estimated at $39.7 million. Gandhi and Patel show that in pesticide application, the red triangle label (extremely hazardous) chemicals have a share of 26 per cent in Andhra Pradesh, 39.7 per cent in Punjab and as high as 65 per cent in Gujarat of the reported use. The yellow triangle label (highly hazardous) group constitutes 59 per cent each in Andhra Pradesh and Punjab and 34 per cent in Gujarat of the reported use. An analysis of the pesticide use behaviour found that pesticide use levels are determined significantly by the extent of irrigation. The intensity of use is higher on small farms. Joshi (1997) shows that with the increase in pesticide use in Punjab, 525 insects have already developed resistance to pesticides. Marothia (1997) reports that nearly 70 per cent of all pesticides consumed by Indian farmers belong to banned or severely restricted categories in the developed countries. The Indian Council of Medical Research conducted an extensive study in 1993 covering all the states of India. Results of this study indicate that the samples far exceeded the tolerance limits of pesticide residuals in the case of milk, canned fruit products, poultry feeds and vegetables. The report emphasises that the private benefits of pesticides use should be evaluated against their social costs. It has been estimated that only 10 per cent of the total foodgrains production can be saved from increased pesticides use. Once the health hazards and other costs are imputed these benefits appear too meagre.

Pesticides also find their way into the river through agricultural runoffs because the upstream catchment areas are intensely cultivated. Around 150 tonnes of pesticides and herbicides are used in the agricultural and plantation areas. The deadly impact of these chemicals has caused destruction of several types of fish and aquatic organisms in recent years.

6. Identifying Environmental Impact of Subsidies to Inputs: An Analytical Framework

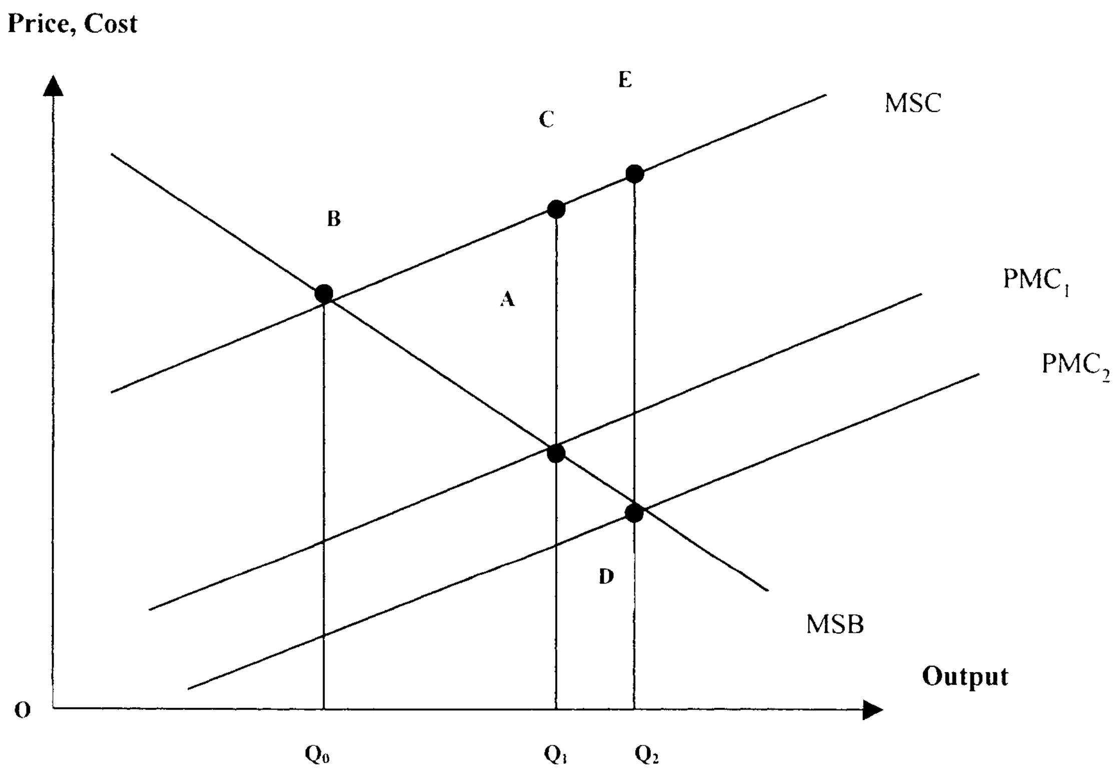
This section presents an analytical framework to identify the environmental impact of subsidies to agricultural inputs and analyse its implications for the sustainability of agriculture, and distinguish whether the subsidy is environmentally positive or perverse. This exercise focusses on three agricultural inputs, namely, fertilisers, irrigation and power.

Since individuals do not necessarily bear the full burden of welfare costs arising from pollution/environmental degradation caused due to their actions they may not have adequate incentives to take these costs into account in making decisions about their consumption and/or production activities. This results in an equilibrium like **A** (Fig. 3.1), where Private Marginal Cost (PMC_1) equals Marginal Social Benefit (MSB)and the output is Q_1. However the optimal equilibrium point is B, where the Marginal social Cost (MSC) equals MSB. It may be noted that at A, the social welfare loss is the area ABC. The government should intervene and take measures such that the PMC coincides with the MSC and there is no welfare loss. However, if the Government gives input subsidies instead, the PMC would shift down to PMC_2, and new equilibrium would be reached at D. Consequently, the social welfare loss would be EBD. It would be noted that the output Q_1 is already socially excessive because environmental externalities are ignored by the economic agents. Further subsidies would result in an increase in welfare loss by CEDA.

As mentioned earlier excessive use of fertiliser, pesticides, surface irrigation and electricity leads to adverse impacts on not only environmental resources but also on human health and welfare (Table 3.1). This section deals with their potential adverse impacts on two environmental resources, namely, water and land resources. These impacts can be on-site or off-site, quantitative or qualitative, and near-term or long-term. It would be seen from Table 3.1 that the potential burdens of these stressors to land are:

soil contamination, waterlogging, salinity, erosion and nutrient leaching. The main negative consequences of soil degradation are on-farm decline of crop production, and off-farm damages as a result of siltation and contamination of water bodies. The magnitude of on-farm effects of soil degradation is not well documented. In general, quantitative empirical work on the relation between soil degradation and yields is scarce, because it requires long-term, longitudinal research. The key soil characteristics that affect yield are organic matter content, nutrient contents, waterholding capacity, soil acidity, topsoil depth and salinity. Yields may decline if one or more of these characteristics is unfavourably affected (depending on which factors are limiting yields in a certain region). Though soil stocks are often large enough to buffer soil degradation but after a critical level of e.g., soil acidity has been reached, a rapid productivity decline may take place.

Figure 3.1



In what follows an analytical model is presented to analyse the link between subsidies to farm input, impact on soil and water resources, and agricultural productivity.

6.1 *The Crop Yield Function*

There is evidence in the empirical literature (see Section 5) that subsidies to agricultural inputs encourage excessive and improper use of these inputs leading to environmental degradation which, in turn, results in a drag yield growth. Since there may be a point at which yields may respond more to the relief of environmental stress than to additional factor intensification, it is important to both identify the environmental factors that may partially be responsible for the slow down of agricultural output and study their impact on agricultural production. A crop yield function with traditional inputs and environmental quality/stress as independent variables is used to identify the effects of inputs used and environmental quality/stress on yield. Negative yield elasticities with respect to the environmental factors would indicate that environmental degradation has adverse effect on output. The coefficients of the traditional input variables would allow to compute the marginal productivity of inputs used. For illustration the yield function can be written as:

$$Y(t) = f\,[F(t), W(t), L, K\,] + g\,[E(t)] \qquad (1)$$

Where Y denotes the quantum of output of the crop in question per unit area and F, W, L, K, are fertiliser, water input, labour and capital per unit area respectively. E denotes the state of the environment or environmental quality (quality of soil, quality and availability of water etc.) and it is a stock variable. The assumption is that the impact of inputs and environmental quality e.g., soil quality on yields, are separable. Y is to be maximised subject to cost constraints.

Inefficient use and overuse of inputs is taken to have significant impact on the environmental quality variables year after year. Therefore, $E(t) = f\,(F,W)$, where F and W are input applications of the past periods. The harmful impact of inefficient and overuse of inputs on agricultural productivity is through E. The effects of environmental degradation say land degradation are assumed to appear to the user of the land as loss of current possibilities and/or loss of production potential.

E comprises E_1, E_2 and E_3 – quality of soil, quality of water and availability of water respectively. It may be noted that the impact of inputs used on E_1, E_2 and E_3 may differ from one region/environmental situation to another. Further, there can be many indicators of deterioration in a given environmental resource – say soil – such as salinity, nutrient imbalance, top soil erosion, compaction of top soil. All of these may not be present/relevant in a given situation. Also, all of these may not be caused due to the use of a single agricultural input/practice. Further, deterioration/depletion in an environmental resource as well as crop yield are highly dependent on climatic and hydrological conditions. It is therefore quite likely that the environmental impacts will differ between regions having different climatic conditions and soil conditions. Of the E_1, E_2, E_3, obtaining an estimate of E_1 is most tricky. E_1 is the soil quality variable determined by a set of physical and chemical properties of the soil. These can be adversely affected overtime through excessive use of irrigation, fertiliser, pesticides and other inputs, and beneficially affected through amelioration measures such as use of organic fertiliser, leveling, provision of drainage etc. Some of these properties may be affected by the actions of others such as neighbouring farmers.

Soil degradation can be considered as the cause of declining yields, or as the consequence of agricultural practices, or as an integral part of agricultural production. In the latter case, the question of cause and effect is no longer relevant, because the processes are endogenised. *Yield functions in which soil/environmental quality is included as a determining variable, like the one used here, consider soil/environmental quality as a cause of yield decline*.

Although the yield function allows one to identify the impact of environmental stress and input use on yield, it does not help to find the extent to which environmental stress is actually is driven by subsidy induced demand for inputs under consideration.

One way to evaluate the effects of subsidy is to estimate the price elasticities. If the price elasticity for, say, fertiliser is negative, then a lower consumer price (everything else unchanged) may lead to higher consumption of fertiliser per unit of land, and hence increase in the stress on the environment. The demand for these inputs is taken to be a function of own price, price of complementary inputs, crop price and non-price factors like availability of credit and cropping pattern. The relative importance of independent variables can be assessed from the demand function. A high magnitude of own price elasticity would indicate that the demand for input is sensitive to its price. A declining (over time) marginal physical productivity of that input (which can be calculated from the yield function) coupled with high own price elasticity would indicate that there is a link between subsidy, demand for input, environmental stress and decline in productivity. Since fertiliser, water and electricity are the three variables which are subsidised and hence targeted here, it would be useful to briefly mention the likely environmental impact of use of these inputs.

6.2 *Environmental Damage and Input Use*

There are two classes of water quality problems associated with nitrogen fertilisers: high concentrations of nitrate in groundwater and damages from eutrophication in coastal and marine waters. High concentrations of nitrate may cause illness to livestock and also create oxygen deficits. Nitrogen transport leads to acidification of soils and of the waters of streams and lakes. There are limits as to how much plant growth can be increased by nitrogen fertilization. When the vegetation can no longer respond to further additions of nitrogen, the ecosystem reaches a state described as "nitrogen saturation". As ammonium builds up in the soil, it is increasingly converted to nitrate and acidifies the soil. Nitrate being highly soluble also leaches into groundwater and runs off into streams. As these negatively charged nitrates seep away, they carry with them positively charged alkaline minerals such as calcium, magnesium and potassium – vital for plant growth – resulting in decrease in soil fertility. As calcium is depleted and the soil is acidified, aluminum ions are mobilised eventually reaching toxic concentrations that can damage tree roots.

"Water has an economic value and should be recognised as an economic good. Failure to recognise the economic value of water, has resulted in wasteful and environmentally damaging uses of the resource, rather than in achievement of efficient and equitable use, and encouragement of conservation and protection" (UN, 1992). Such policy pronouncements notwithstanding economic realities too often have not influenced water policy. Water is frequently artificially priced below its real value, thereby promoting wasteful and inefficient use and, consequently, increased scarcity, with dire consequences on quality. One of the most persistent environmental problems is contamination of ground and surface water by agricultural activities, application of pesticides, chemical fertilisers, and soil erosion. Chemical contamination can occur from residues that accumulate in the soil, run off into streams, and leach into deep-percolating groundwater. Contamination of streams and ground water causes health hazards for livestock and humans. Deep percolating water from irrigation accumulates and, when it reaches the topsoil, creates salinity which eventually eliminates agricultural productivity. Unsustainable extraction of groundwater may also adversely affect the crop productivity, restrict the choice of crop, cause salinity ingress in coastal areas and cause drying of wells. Over pumping of groundwater away from coastal areas can also lead to salt-water intrusion. This may cause irreversible damage to groundwater acquifers because it compromises their capacity to retain fresh water from rainfall and other sources.

6.3 *Input Demand Functions*

The two inputs considered here are fertiliser and water. Demand functions for these inputs can be derived by maximising the yield function subject to cost constraint. And for the given price of inputs the level of inputs demanded (F^*, W^*) can be determined. If $F^* > \bar{F}$ - where $\bar{F}$ is environmentally sustainable amount of fertiliser for the given crop – it would imply that fertiliser consumption is more than the environmentally sustainable amounts hence any element of subsidy in fertiliser would be essentially perverse. Conversely, if $F^* < \bar{F}$ it would imply a positive subsidy. However, since information available in India on recommended doses of inputs used does not take the environmental sustainability into account such a comparison may not be appropriate until reliable information is made available on environmentally sustainable doses of inputs. Demand function for fertiliser may be written as:

$$F = g_1 (P_F, P, P_W) \qquad (2)$$

where P_F, P and P_w are price of fertiliser, price of output and price of water – the complementary input – respectively.

$$\frac{\partial F}{\partial P_F} < 0, \frac{\partial F}{\partial P_W} < 0, \frac{\partial F}{\partial P} > 0$$

The demand function for water:

Water for irrigation has various sources: rainfall, surface water bodies and water from underground sources. Both groundwater and surface (canal) water may be used for irrigation. As noted earlier, there are substantial subsidies on surface water for irrigation and on electricity used in pumping groundwater. In regions where groundwater is brackish, canal water becomes the main source of irrigation. Regions where canal network is underdeveloped and groundwater is of good quality, use of groundwater is predominant. In some regions in spite of well developed canal systems irrigation is largely dependent on groundwater because it is relatively less costly due to huge subsidies on electricity. Thus, we formulate demand functions separately for canal water (W_1) and groundwater (W_2).

The demand function for canal irrigation can be written as:

$$W_1 = g_3 (P_C, P, P_F, R) \qquad (3)$$

Where R is the rainfall for relevant months of crop in a state/farm.

$$\frac{\partial W_1}{\partial P} > 0$$

$$\frac{\partial W_1}{\partial P_C} < 0 \qquad \forall P_C < P_0 \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(a)$$

$$W_1 = W_0 \qquad \forall P_C \geq P_0 \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(b)$$

$$\frac{\partial W_1}{\partial R} > 0$$

Similarly, demand for groundwater would depend on the crop price (P), electricity charges (P_e), P_F and R.

$$W_2 = g_3 (P_e, P, P_F, R) \tag{4}$$

$$\frac{\partial W_2}{\partial P} > 0$$

$$\frac{\partial W_2}{\partial P_e} < 0 \qquad \forall \qquad P_e < (P)_0 \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (c)$$

$$W_2 = W_0 \qquad \forall \qquad P_e \geq (P)_0 \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (d)$$

$$\frac{\partial W_2}{\partial R} < 0$$

A low/high value of own price elasticity would imply low/high demand sensitivity of input with respect to its price. Those regions where input price elasticity is low and environmental benefits per unit decrease in application of that input is high, could be used as target zones to reduce subsidies. *An increase in input price would only marginally reduce its consumption (due to low price elasticity), thus current yield levels would not be affected much, at the same time burden of subsidies on the fiscal system and environmental stress would be reduced.*

6.4 *Identifying Impact of Input Use on the Environment*

This section attempts to identify the impact of use of agricultural inputs viz; fertiliser and irrigation on environmental resources: soil, and surface and underground water. *While the use of agricultural inputs helps improve the crop yield as well as maintain the environmental quality of soil, excessive use of these inputs results in environmental degradation which, in turn, negatively affects the yield and leads to increased welfare costs.*

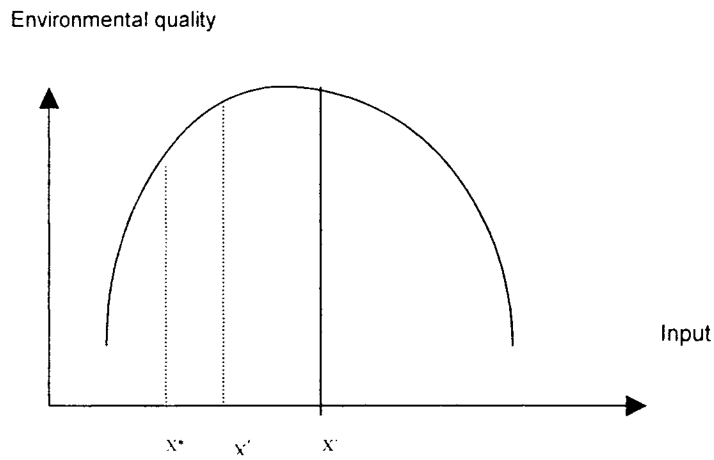
Let Ê - an index of quality of an environmental resource – be a function of the input X used [Ê = z(X)] over the years. For any given environmental quality of a resource, use of input X upto X' leads to improvement in quality of this resource (Figure 3.2). Input use in excess of X′ in any period would lead to a decline in quality of this resource.

Figure 3.2

$$\frac{\partial \hat{E}}{\partial X} > 0 \forall X < X'$$

$$\frac{\partial \bar{E}}{\partial X} = 0 \, for X = X'$$

$$\frac{\partial \bar{E}}{\partial X} < 0 \forall X > X'$$



(i) As noted earlier, indiscriminate use of fertiliser has both on-farm and off-farm negative externalities. Thus, for fertiliser we consider 2 effects; (i) effect on soil quality and (ii) effect on water quality[1]. Let E_1 and E_2 be the soil and water quality indicators respectively.

$$E_1 = h_1 (F) \quad \text{and } E_2 = h_2 (F) \qquad (5)$$

F is assumed to affect E_1 and E_2 over time.

[1] Affects groundwater through leaching and affects surface water bodies through agricultural runoffs.

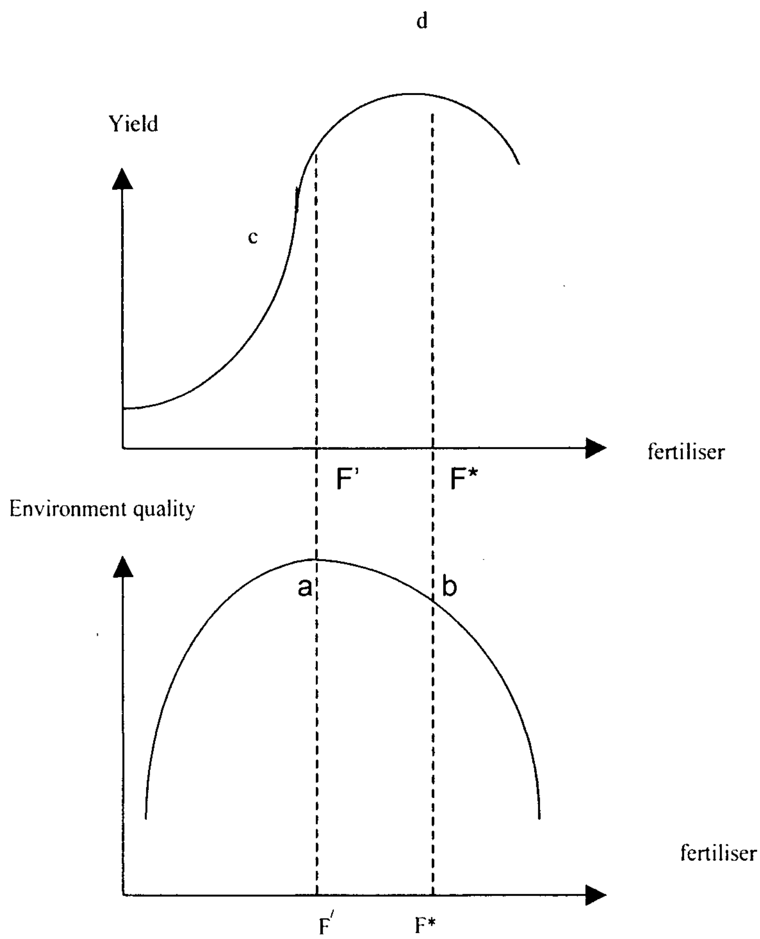
Fertiliser application improves the nutrient level of the soil on one hand and on the other hand every unit of fertiliser used disposes some toxic elements. The environment can withstand disposal of chemical residues to some extent. However, greater use of certain fertilisers affects the nutrient balance of soil and deposits too much synthetic residues, and the overall soil quality deteriorates and this deterioration is exhibited in decreasing improvements in yield per unit of fertiliser used in excess of X'.

If environmental quality function was available for different agricultural and environmental situations it would be straight forward to determine the environmentally sustainable levels of the given inputs. However, this information is not available in the Indian context. Given this, an alternative way to identify the impact of input use on environmental quality and crop yield could be as follows.

There is evidence in the empirical literature to show that yield is sensitive to the quality of environmental resources. This is depicted in Figure 3.3. Let us take the environmental resource and input to be the soil and fertiliser respectively. It would be seen from Figure 3.3 that if the quantity of fertiliser applied is less than F in any period, the quality of soil would be on the left of the point 'a' (implying no negative effect on soil due to fertiliser application in period t) and increasing returns to scale for fertiliser for the given crop would be obtained. When soil quality is on the right of point 'a' but between points 'a' and 'b', changes in fertiliser application would have an impact on the yield which would manifest itself in deceleration in the rate of growth of yield. If current practices/levels of fertiliser use are such that the soil quality is on the right of 'b', an absolute decline in yield would be observed. Thus, the marginal productivity curve can be taken as a proxy to the environmental quality curve. However, the environment quality curve will be unique for the given crop, input, soil type, and any other relevant factors.

It may be useful to mention here that incorporating environmental information directly into production function analysis, using econometric techniques is becoming increasingly popular (Mausolff and Farber, 1995; Pattanayak and Mercer, 1998; and Byiringiro and Reardon, 1998). The limitation of this approach is that it is difficult to unequivocally determine the exact effects of soil/environmental degradation on yields in the short-run. Comparative studies of more or less severely degraded phases in the same region may show the difference between severely and slightly degraded soil (Weesies et al., 1994; Olson et al., 1994), but do not provide the information to quantify the dynamic effects of soil degradation on yields.

Figure 3.3



As noted earlier, the environmental impact of inputs used may differ from one region/environmental situation to another, both in ways and magnitudes under different cropping system and farming methods. Further, there can be many indicators of deterioration in a given environmental resource, all of these may not be affected in a given situation. Therefore, there is a need for case studies focussing on one or more significant impacts of an area's predominant production practices. To gauge potential improvement/deterioration in environmental resource due to alternative production practices and inputs use, long-term field studies would be required. The rates of erosion of natural resources obtained from such studies would allow quantification of environmental costs under different scenarios and in framing of related policies.

(ii) Waterlogging and salinisation of soil are externalities which arise due to excess and inefficient use of canal irrigation. The impact of water logging and salinity on soil quality can be represented by:

$$E_3 = h_3 (W_1) \tag{6}$$

(iii) Several studies have shown that subsidies on electricity have induced excessive withdrawal and application of water which has led to decline in groundwater table. This resource assumes special importance as it has a bearing on sustainable agricultural development. Let the state of groundwater table be represented by:

$$E_t = \text{Groundwater level}_{t-1} + \text{Water recharge}_{(t)} - W_{2(t)} \quad (7)$$

E_t determines both the cost and availability of water for future agriculture. The sustainable quantity of water withdrawal would vary from region to region depending on the groundwater level and water recharge rate in the given region. Electricity consumption e is related to water withdrawal by the following function:

$$e = h_4 (W_2) \quad (8)$$

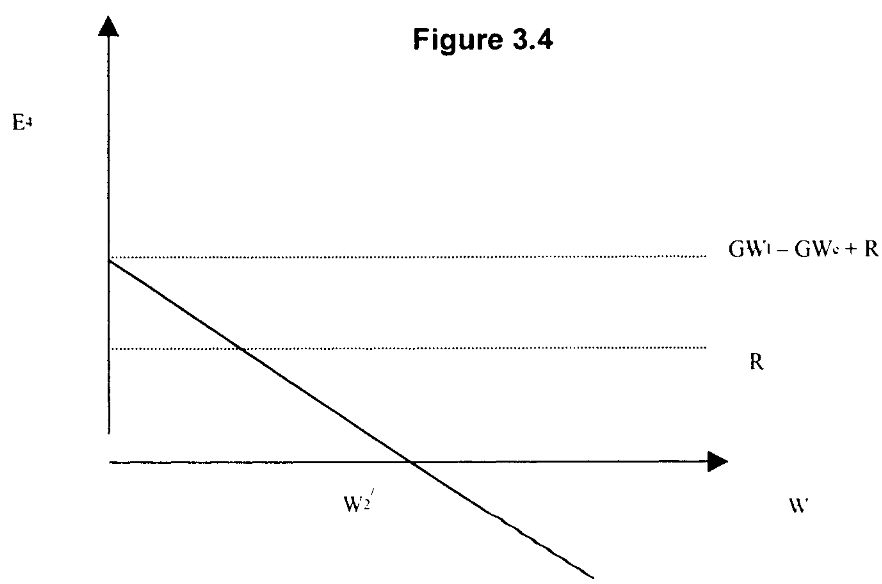
$$e = h_5 (P_e, P, P_F) \quad (9)$$

In (7) above if the rate of water withdrawal (W) is more than the rate of natural recharge (R), the groundwater level would fall. Let GW_I be the groundwater level at the beginning of period t, GW_C be the critical level of groundwater below which the groundwater is in danger of terminal decline. The existence of a critical level may be explained by factors such as salinity ingress in coastal areas and salt water intrusion and irreversible damage to groundwater acquifers in areas away from coastal areas. The state of groundwater at time t can be represented as:

$$E_4 = (GW_I - GW_C) + (R - W) \quad (10)$$

This relationship is shown in Figure 3.4.

Figure 3.4



For sustainability of environment as well as agriculture, the water withdrawal should not exceed W_2'.

The demand functions for fertilisers and irrigation water (2), (3) and (4) would give $\frac{\partial F}{\partial P_F}, \frac{\partial W_1}{\partial P_W}$ and $\frac{\partial W_2}{\partial P_e}$. We generalise this as $\frac{\partial X}{\partial P_X}$, or the change in input (X) demanded per unit change in price. Let $\frac{\partial E}{\partial X}$ be the rate of environmental quality change due to the change in the quantity of X.

$\frac{\partial E}{\partial X}$ can be obtained from (5), (6) and (10).

Hence, $\frac{\partial E}{\partial X} \cdot \frac{\partial X}{\partial P_X} = \frac{\partial E}{\partial P_X}$ (11)

From this expression we can get the environmental quality change due to change in price of the given input at the corresponding level of input use and price.

7. Distinguishing between Positive and Perverse Subsidies

From Figures 3.2, 3.3 and 3.4 we have the environmentally sustainable levels of inputs use - X, F and W_2. It would be seen from these figures that the optimal levels of input correspond to the inflexion points of the yield function for fertiliser and surface irrigation. The environmentally sustainable level of withdrawal of groundwater is at W_2.

If F* (input demand of the farmer) > F' and W* > W' for surface irrigation and $W^*>W_2$ for groundwater irrigation, then the subsidy element in P_F, P_W and P_e would be perverse. In other words, the price change necessary to bring down input use to its optimal level is perverse subsidy. If F* and W* are less than optimal levels then the necessary price change to increase input use to optimal level would be positive subsidy.

From the demand functions we will get $\frac{\partial F}{\partial P_F}$ and $\frac{\partial W}{\partial P_W}$. F*>F would indicate the need to decrease F* through change in P_F.

$\Delta F = F^* - F'$

The necessary change in price will be ΔP_F, where

$$\frac{\partial F}{\partial P_F} = \frac{\Delta F}{\Delta P_F} or \Delta P_F = \frac{\Delta F}{\partial F / \partial P_F}$$

Therefore, ΔP_F is the amount of perverse subsidy in the given input.

The analytical framework presented above focussed its attention in identifying the environmentally optimal levels of input use and also served to derive the price changes needed in order to move the farmers towards the social optimum.

We next address this issue as an optimal control problem and obtain a price structure for the given input that will address the problem of overuse and will be environmentally optimal. This is done for nitrogenous fertiliser and the control variable for the social planner is the price of nitrogenous fertiliser. A similar analysis for water can be found in Nir Becker, et. al. (2000).

8. An Environmentally Optimal Nitrogen Fertiliser Price Regime

Until recently, the supply of nitrogen available to plants -- and ultimately to animals -- has been quite limited. Although it is the most abundant element in the atmosphere, plants cannot use nitrogen from the air until it is chemically transformed, or fixed, into ammonium or nitrate compounds that plants can metabolise. In nature, only certain bacteria and algae (and, to a lesser extent, lightning) have this ability to fix atmospheric nitrogen, and the amount that they make available to plants is comparatively small. As a consequence, nitrogen is a precious commodity -- a limiting nutrient -- in most undisturbed natural systems. All that has changed in the past several decades. Driven by a massive increase in the use of fertiliser, the burning of fossil fuels, and an upsurge in land clearing and deforestation, human activities now contribute more to the global supply of fixed nitrogen each year than natural processes do. There is a limit to the amount of nitrogen that natural systems can take up; beyond this level, serious harm can ensue. In terrestrial ecosystems, nitrogen saturation can disrupt soil chemistry, leading to loss of other soil nutrients such as calcium, magnesium, and potassium, acidification of soil and ultimately to a decline in fertility. Curbing the nitrogen overload will mean acting on several fronts. Making fertiliser applications more efficient is one of the most promising options. This problem is also evident in developing countries like India where one of the major factors resulting in the overuse of nitrogen fertiliser is the improper price structure of the fertiliser. Nitrogen fertiliser is heavily subsidised and this results in its overuse, so much so that fertiliser subsidy bill touched Rs. 100 billion in 1997-98 almost 1one per cent of GDP[2]. Here we will present a framework for attaining an environmentally optimal nitrogen fertiliser price regime. But first we need an understanding of environmental impact of nitrogen fertiliser overuse.

8.1 The Nitrogen Cycle[3]

Nitrogen is an essential component of proteins, genetic material, chlorophyll, and other key organic molecules. All organisms require nitrogen in order to live. It ranks fourth behind oxygen, carbon, and hydrogen as the most common chemical element in living tissues. Until human activities began to alter the natural cycle, however, nitrogen was only scantily available to much of the biological world. As a result, nitrogen served as one of the major limiting factors that controlled the dynamics, biodiversity, and functioning of many ecosystems.

The Earth's atmosphere is 78 percent nitrogen gas, but most plants and animals cannot use nitrogen gas directly from the air as they do carbon dioxide and oxygen. Instead, plants — and all organisms from the grazing animals to the predators to the decomposers that ultimately secure their nourishment from the organic materials synthesised by plants — must wait for nitrogen to be "fixed," that is, pulled from the air and bonded to hydrogen or oxygen to form inorganic compounds, mainly ammonium (NH_4) and nitrate (NO_3), that they can use.

The amount of gaseous nitrogen being fixed at any given time by natural processes represents only a small addition to the pool of previously fixed nitrogen that cycles among the living and nonliving components of the Earth's ecosystems. Most of that nitrogen, too, is unavailable, locked up in soil organic matter — partially rotted plant and animal remains — that must be decomposed by soil microbes. These microbes release nitrogen as ammonium or nitrate, allowing it to be recycled through the food web. The two major natural sources of new nitrogen entering this cycle are nitrogen-fixing organisms and lightning.

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2 Gulati, A. and Sudha Narayan (2000), "Demystifying fertiliser and Power Subsidies in India", EPW March 2000.

3 For details see; Kasica Amy Fay (1997), "Something to Grow on", Cornell Cooperative Extension, Dept. of Floriculture and Ornamental Horticulture, Cornell University.

8.2 *Human-Driven Nitrogen Fixation*

During the past century, human activities clearly have accelerated the rate of nitrogen fixation on land, effectively doubling the annual transfer of nitrogen from the vast but unavailable atmospheric pool to the biologically available forms. The major sources of this enhanced supply include industrial processes that produce nitrogen fertilisers, the combustion of fossil fuels, and the cultivation of soybeans, peas, and other crops that host symbiotic nitrogen-fixing bacteria[4].

The impacts of human domination of the nitrogen cycle that we have identified with certainty include:

- Losses of soil nutrients such as calcium and potassium that are essential for long-term soil fertility;
- Substantial acidification of soils and of the waters of streams and lakes in several regions;
- Increased global concentrations of nitrous oxide (N_2O), a potent greenhouse gas, in the atmosphere as well as increased regional concentrations of other oxides of nitrogen (including nitric oxide, NO) that drive the formation of photochemical smog;
- Greatly increased transport of nitrogen by rivers into estuaries and coastal waters where it is a major pollutant.

8.3 *Nitrogen Saturation and Ecosystem Functioning*

There are limits to how much plant growth can be increased by nitrogen fertilisation. At some point, when the natural nitrogen deficiencies in an ecosystem are fully relieved, plant growth becomes limited by scarcity of other resources such as phosphorus, calcium, or water. When the vegetation can no longer respond to further additions of nitrogen, the ecosystem reaches a state described as "nitrogen saturation."

As ammonium builds up in the soil, it is increasingly converted to nitrate by bacterial action, a process that releases hydrogen ions and helps acidify the soil. The build-up of nitrate enhances emissions of nitrous oxides from the soil and also encourages leaching of highly water-soluble nitrate into streams or groundwater. As these negatively charged nitrates seep away, they carry with them positively charged alkaline minerals such as calcium, magnesium, and potassium. Thus human modifications to the nitrogen cycle decrease soil fertility by greatly accelerating the loss of calcium and other nutrients that are vital for plant growth. As calcium is depleted and the soil acidified, aluminum ions are mobilised, eventually reaching toxic concentrations that can damage tree roots or kill fish if the aluminum washes into streams. Trees growing in soils replete with nitrogen but starved of calcium, magnesium, and potassium can develop nutrient imbalances in their roots and leaves. This may reduce their photosynthetic rate and efficiency, stunt their growth, and even increase tree deaths.

8.4 *Future Prospects and Management Options*

8.4.1 Fertiliser Use

The greatest human-driven increases in global nitrogen supplies are linked to activities intended to boost food production. Modern intensive agriculture requires large quantities of nitrogen fertiliser; humanity, in turn, requires intensive agriculture to support a growing population. Consequently, the production and application of nitrogen fertiliser has grown exponentially, and the highest rates of application are now found in some developing countries with the highest rates of population growth. Curtailing this growth in nitrogen fertiliser production will be a difficult challenge.

The challenge is to obtain a price structure for the nitrogen fertiliser that will address the problem of overuse and will be environmentally optimal. Here we try to address the issue as an optimal control problem, where the control variable for the social planner is the price of nitrogen fertiliser.

In some optimal control models the environmental degradation is taken as a flow variable[5]. However Foster (1980) uses pollution both as a stock and a flow variable. In this model we capture the environmental impact of the overuse of nitrogen fertiliser (thus taken as flow variable), as well as the impact of nitrogen fixed in the ecosystem (taken as a stock variable).

4 Brah, N. and Fred Schellaman (1999), "Green Purchasing of Agri-foods", Background Paper, Department of environmental management, De Bilt, Netherlands.

5 Foster, Bruce A. (1980), "Optimal Energy Use in a Polluted Environment", *Journal of Environmental Economics and Management*, pp. 321-333.

8.4.2 *The Model*

Let $P(t)$ denote the price of nitrogen fertiliser normalised by the price of output of the agricultural produce. Let $n(P)$ be the demand/use of nitrogen fertiliser. $N(t)$ is a measure of nitrogen fixed in the ecosystem. The agricultural yield depends on the use of nitrogen fertiliser and the nitrogen fixed in the ecosystem:

$$Y = F\,[N(t),\, n(P)] \tag{1}$$

We assume an additive quadratic functional form for yield (Y) in terms of use of nitrogen fertiliser (n) and the nitrogen fixed in the ecosystem (N). The yield function takes the following form:

$$Y = \alpha + \beta N - \gamma N^2 + \delta n - \varepsilon n^2 \tag{2}$$

The nitrogen fertiliser demand by the farmer is obtained from his optimisation behaviour. Assume a simple profit maximising behaviour of the farmer who is faced with a production function that is quadratic in nitrogen fertiliser use. We get a simple linear demand function of nitrogen fertiliser for the farmer. Demand for nitrogen fertiliser $n(P)$ *is*:

$$n = \xi - \eta P \tag{3}$$

The change in nitrogen fixed in the ecosystem an any point of time will depend on the use of nitrogen fertiliser and the natural rate of change in the stock. Thus we have the following relation:

$$\dot{N} = \lambda - \omega P - \nu N \tag{4}$$

Since n depends on P, the only other variable in the model is N. In the model P is the control variable as n can be substituted by it. Since N is the dynamically driven by the control variable P, it is clear that N plays the role of state variable here and the equation of motion for N is given by *(4)*.

8.4.3 *The Optimal Control Problem*

If a social planner is appointed to plan and chart the optimal time path of the price variable p taking the environment impact of fertiliser use into account the optimal control problem in the infinite horizon that he must solve takes the form:

$$\underset{P}{Maximise} \int_0^{\alpha} Y[N, n(P)]e^{-pt}dt \tag{5}$$

$$subjectto\ \dot{N} = \lambda - \omega P - vN$$

$$N(0) = N_0$$

$$and \quad P(t) \geq 0$$

Where p is the discount factor.

8.4.4 *The Maximum Principle*

The current value Hamiltonian for the problem is:

$$H_c = Y() + m(\lambda - \omega P - vN) \tag{6}$$

Where

$$m = \mu e^{pt} \tag{7}$$

and μ is the costate variable i.e. shadow price of the state variable N. The maximum principle conditions are:

$$\underset{P}{Maximise} \quad H_c$$

$$\dot{N} = \frac{\partial H_c}{\partial m} \qquad \text{(equation of motion for } N\text{)} \tag{8}$$

$$\dot{m} = -\frac{\partial H_c}{\partial N} + \rho m \qquad \text{(equation of motion for m)}$$

and the transversality conditions

To maximise H_c with respect to the control variable P, where $P \geq 0$, the Kuhn–Tucker condition is $\partial H_c/\partial P \leq 0$, with the complementary slackness proviso that $P(\partial H_c/\partial P) = 0$. But inasmuch as we can rule out the extreme case of $P = 0$, we postulate $P > 0$. It then follows from the complementary slackness, that for maximisation we must satisfy the condition:

$$\frac{\partial H_c}{\partial P} = \delta n_P - 2\varepsilon n n_P - \mathrm{m}\omega = 0 \qquad (9)$$

Where $n_P = \partial n/\partial P$, from (9) we obtain the condition:

$$m(t) = \; - P(t) \qquad (10)$$

Where $\chi = 2\varepsilon\eta^2/\omega > 0$, and $\varphi = (-\delta\eta + 2\varepsilon\eta\xi)/\varpi$, hence we can not be sure about the sign of φ.

Condition *(10)* does maximise H_c because:

$$\frac{\partial^2 H_c}{\partial P^2} = -2\varepsilon\eta^2 < 0 \qquad (11)$$

The equation of motion for the state variable N can be read directly from the second line of *(8)*, but it can also be derived as:

$$\dot{N} = \frac{\partial H_c}{\partial m} = \lambda - \omega P - \nu N \qquad (12)$$

And the equation for motion for the current value multiplier m is:

$$\begin{aligned} \dot{m} &= -\frac{\partial H_c}{\partial N} + \rho m = -(\beta - 2\gamma N - \nu m) + \rho m \qquad (13 \\ &= -\beta + 2\gamma N + (\nu + \rho)m \end{aligned}$$

The ensuing discussion will be based on the current value maximisation principle conditions *(10)*, *(12)* and *(13)*. Since there is no explicit t argument in these, we have an autonomous system. This makes possible a quantitative analysis by a phase diagram.

8.4.5 *Constructing a Phase Diagram*

Since the two differential equations *(12)* and *(13)* involve the variables N and m the normal phase diagram will be in Nm space. We shall depart from this procedure and using (10) we will eliminate the m variable. In doing so we shall create a differential equation in P. The analysis can then be carried out with a phase diagram in the NP space. We begin by differentiating *(10)* with respect to t, to obtain the following expression:

$$\dot{m} = -\chi \dot{P} \qquad (14)$$

This expression together with *(10)* when used in *(13)* gives us:

$$\dot{P} = \Phi - \Gamma N + \Psi P \qquad (15)$$

Where $\Psi = (\nu + \rho) > 0$, $\Gamma = 2\gamma/\chi > 0$ and $\Phi = [\beta + (\nu + \rho)\phi]/(-\chi)$. Hence we do not know the sign of Φ. We now have to work with the differential equation system given by *(15)* and *(12)*. To construct the phase diagram, we first draw the following curves:

$$N = (\Phi / \Gamma) + (\Psi / \Gamma) P \qquad \text{(Equation for } \dot{P} = 0 \text{ curve)} \qquad (16)$$

$$P = (\lambda / \omega) - (\nu / \omega) N \qquad \text{(Equation for } \dot{N} = 0 \text{ curve)} \qquad (17)$$

These curves are drawn in NP space in figure 1.

8.4.6 *The Phase Diagram Solution*

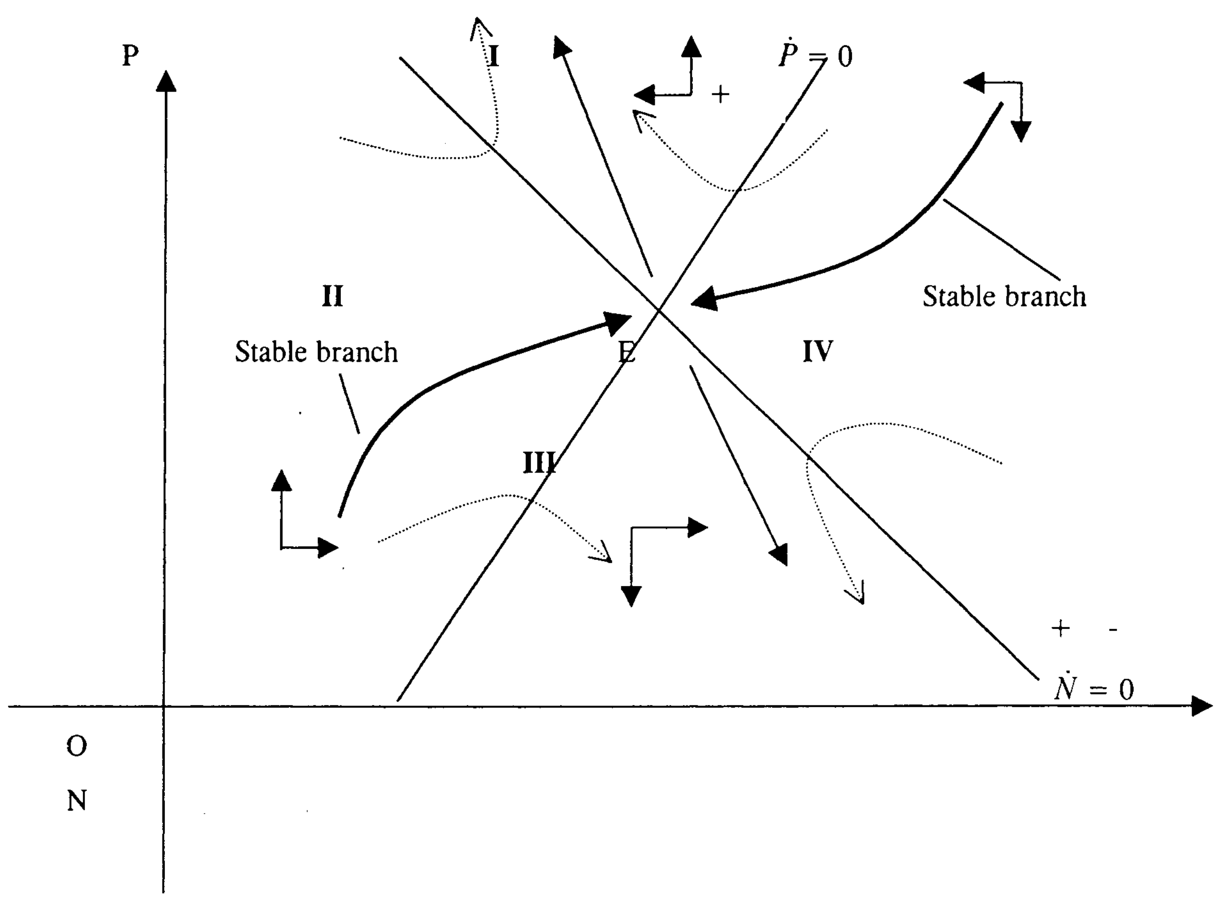
To prepare an analysis of phase diagram, we have, in figure 3.5, added vertical and horizontal sketching bars. Point E where both N and P are stationary represents the intertemporal equilibrium of the system. At any other point however either N or P (or both) would be changing over time. For clues about the general directions the streamlines (Phase trajectories) will take, we partially differentiate *(15)* and *(12)* to get:

$$\frac{\partial \dot{N}}{\partial P} = -\omega < 0 \qquad (18)$$

and

$$\frac{\partial \dot{P}}{\partial N} = -\Gamma < 0 \qquad (19)$$

Figure 3.5



According to *(18)*, as P increases, $\dot{N}$ Should follow the (+, 0, -) sign sequence. So, the N-arrowheads must point eastward below the $\dot{N} = 0$ curve, and westward above it. Similarly *(19)* indicates that $\dot{P}$ should follow the sign sequence (+, 0, -) as N increases. Hence P arrowheads should point northward to the above $\dot{P} = 0$ curve, and southward below it. The streamlines drawn in accordance with such arrowheads yield a saddle-point equilibrium at point E, $(\overline{N}, \overline{P})$, where $\overline{N}$ and $\overline{P}$ denote the intertemporal equilibrium values of N and P, respectively.

The only way the system can ever move towards the steady state is to get onto one of the stable branches – the dark lines – leading to point E. this means given the initial nitrogen fixed in the system N_0 we must choose an initial price P_0 such that the ordered pair (N_0, P_0) lies on a stable branch. The dynamic forces of the model represented by the solution of simultaneous equation system *(15)* and *(12)*, would lead us to the intertemporal equilibrium E. The requirement that we must choose an initial price P_0 such that the ordered pair (N_0, P_0) lies on a stable branch takes care of the transversality conditions.

8.5 Conclusion

If the system is not on one of the stable branches then the dynamic forces of the model will lead us into a situation of either

(i) ever increasing N accompanied by ever decreasing P (along the stream lines that point towards the Southeast), or

(ii) ever increasing P accompanied by ever decreasing N (along the stream lines that point towards the Northwest).

Situation (i) implies ever-increasing nitrogen fixation, which will have serious long-term environmental consequences, and situation (ii) implies ever-increasing nitrogen fertiliser price leading to decreasing nitrogen fixation, which in the long term will have serious consequences for food security. Hence the environmentally optimal solution is to choose an initial price P_0 such that the ordered pair (N_0, P_0) lies on a stable branch, then the dynamic forces of the model represented by the solution of simultaneous equation system *(15)* and *(12)*, would lead us to the intertemporal equilibrium E. Point E gives the environmentally optimal price of nitrogen fertiliser $\overline{P}$ in the equilibrium and the stable branches give the environmentally optimal time path of the nitrogen price.

CONTROLLING ENVIRONMENTAL DEGRADATION: INTERNATIONAL EXPERIENCE 4

It has been increasingly realised in many areas of the world that today's agriculture is unsustainable with the symptoms of unsustainability now becoming apparent throughout the world's farming regions – salinisation, erosion, soil compaction and water logging and water pollution and depletion. Several measures have been suggested that can be effectively used to control environmentally harmful impacts of agriculture. These range from command and control measures to market based instruments and public expenditure policies.

1 Controlling Fertiliser Application

The following measures have been suggested to affect the use of chemical fertilisers.

(i) Regulation of fertiliser use by various means such as direct control and permit systems.

(ii) Imposition of taxes to make inorganic fertilisers more expensive. However, the effectiveness of such a tax would largely depend upon the price elasticity of demand for fertilisers.

(iii) Reduction in support prices of crops which are more chemical fertiliser intensive.

(iv) Change in farming patterns and a shift away from high fertiliser demanding crops.

(v) Change in land use patterns in favour of afforestation and the introduction of set-aside schemes. This has already been in operation in North America and some countries of Europe. For example, in 1993, in Britain around 1.5 million acres were taken out of crop production voluntarily and in return farmers received sterling pound 84 on every productive arable acre they farmed.

1.1 The UK Policy on Nitrate Pollution

Being a member of the European Community the UK is required to comply with the minimum environmental standards set by the Commission. The European Commission's Drinking Water Directive of 1980 limits nitrate in drinking water to 50 mg per litre, a limit which has not been achieved in all cases. The commission's Draft

Directive 88 requires a number of further management actions to reduce nitrate levels in surface and groundwater by way of stocking limits, set-aside, afforestation and cutting down on application to land.

In response to Draft Directive 88 the UK introduced a nitrate sensitive pilot project in ten areas of England, amounting to 16,400 ha. Participation in these schemes is voluntary, but those who take part in the nitrate sensitive areas receive a payment on the basis of per hectare of land for their co-operation. Farmers participating in this pilot project agreed not to use nitrate in autumn, maintain a winter crop, maintain hedgerows, ponds and woods, and apply no more than 120 kg of nitrate per hectare at any one time. In order to qualify for payment, farmers must enter into an agreement for at least five years.

2 Water Conservation Strategies

Water management strategies and their proper implementation is also necessary in water scarce areas. In the literature, the strategy suggested for water scarce areas is to maximise productivity per unit of water as opposed to maximising per unit of land through shifting of the cropping pattern in favour of less water intensive crops. The Technical Committee on Drought Prone Areas Programme and Desert Development Programme (Government of India, 1994) also recommended substituting water intensive crops like sugarcane and paddy with less water using crops in water scarce areas.

Demand for water can also be reduced by soil mulching and using soil additives. Mulches minimise surface evaporation losses besides influencing soil productivity and controlling weeds. 'Jal Shakti', a super absorbent polymer, developed by National Chemical Laboratory (NCL), Pune and suitable as soil additive has tremendous capacity to absorb water several hundred times its weight. When added to soil, it can absorb water applied and can release the same slowly over an extended period. As a result, irrigation frequency would diminish resulting in improvement in water use efficiency. The performance of this material has been found satisfactory in the command area of Pachamba lift irrigation scheme in Maharashtra. The use of 'Jal Shakti' in mango brought down number of irrigations required from 23 to 11 thus saving water by 50 per cent (Satyasai and Viswanathan, 1997).

The conventional methods of irrigation in India consist of flooding the field in case of field crops or flooding the root zone of the crop by making furrows or check basins in case of horticulture and cash crops. The sprinkler irrigation system consists of conveying the water to the field by aluminium, steel or polyvinyl chloride pipes distributing it over the field under pressure through a system of nozzles. The seepage and evaporation losses are eliminated by this method and required depth of water is applied uniformly even in undulating fields. The drip irrigation is precise and slow application of water in the form of discrete drops, continuous drops, tiny streams and miniature emitters or applicators located at selected points along water delivery lines. The water is applied near the root zone of plant via a network of aims, filtration unit, control valves and laterals for attaining uniform application for each plant. According to Satyasai and Viswanathan (1997), field experiments have shown that the sprinkler and drip irrigation systems can save water upto 30 and 60 per cent, respectively, and increase crop yield and improve the quality of the crop.

3 Controlling Pesticide Application

Governments in many countries subsidise pesticide production and sales by a variety of mechanisms. These subsidies make pesticides considerably cheaper to the farmers than their full costs of supply. This encourages farmers to use more chemicals than they would if they had to pay the full costs. By the same token, subsidies discourage farmers from controlling pests by methods that rely less heavily on chemical applications. These subsidies undermine efforts to promote the alternative cost-effective methods of integrated pest management, which resort to pesticide sprays only when the potential crop losses reach a threshold level of economic damage.

In April 1985, the World Bank announced new policy guidelines governing pesticide use in the projects it finances. Those guidelines recognise the risks of excessive reliance on chemicals and state: "Sound pest management should aim to reduce dependence on chemical pesticides through the establishment of economic control thresholds and through the use, wherever possible, of agroeconomic and related practices which reduce the severity of pest attacks." Unfortunately, subsidisation of chemicals lowers the economic control threshold as perceived by farmers and encourages farmers to use chemicals instead of alternative agroeconomic and cultural practices.

Various instruments have been suggested to regulate pesticide use. Some of them have been listed below.

(i) A complete ban on the most harmful substances.

(i) Quantity regulation in the form of a quota on active ingredients as well as application. However, variations in pesticide and methods of application make the administration of the quota system complicated. Variations in regions as well as climate are some other factors which can make the operation of the quota system difficult.

(ii) As an economic instrument, taxation can be used to reduce application of pesticides in agriculture. This is a flexible method of control, which can be changed from year to year in response to pest-infestation levels, climate variations, agricultural patterns and other variables. Tax on pesticides can create an incentive to improve pest management systems, including the composition of chemicals and the efficiency of spraying equipment.

(iii) The most desirable effect of taxation or a quota system could be the innovation and adoption of safe, natural biological controls. Natural control is the conservation of natural enemies by preventing their destruction or preserving their habitats. Choice of plant varieties, maintenance of alternative hosts, and proper soil management can be employed to keep enough beneficial species active to control pests. For example, in some crops such as tomatoes, white fly has been controlled by breeding their known predators. Winter moth in Canada is controlled by the introduction of its natural predators. Faeth (1993), suggests that increasing crop diversity through intercropping or polyculture reduces damage from insect pests by providing habitat for natural enemies.

Varietal resistance has been employed by Philippines to control yield losses from pests. Most modern varieties of rice released after the mid 1970s are resistant to brown planthopper and green leafhopper and have some resistance to stemborer. Stemborers are mostly controlled by selecting early maturing varieties. Varietal resistance is particularly important in controlling viral diseases for which there are few control options of any kind and none after planting. Faeth (1993) states that varietal resistance when used with the natural control strategy could be just as successful as judicious pesticide use, except in years when there is an unusually large pest outbreak.

Cultural practices is yet another pest management option. By definition it includes the physical manipulation of the insect environment and excludes application of chemical pesticides and the introduction of resistant varieties or natural pest enemies. Practices for cultural control include cultivation and rotation, timing of planting and harvesting, and variation of plant density and nutrient use.

In 1972 the USA introduced the Federal Insecticide, Fungicide and Rodenticide Act for regulation of application as well as production of pesticides and herbicides. According to this Act no new pesticide or herbicide can be sold in the US without the approval of the Environmental Protection Agency (EPA). Furthermore, permission must be sought for any new use of an already approved agrochemical. All new products must pass a number of tests designed to identify hazards to human health and the environment. Regulations cover application dose, frequency, ingredients and labelling. A product can be removed from the market if a harmful effect becomes apparent, even long after its introduction.

In the 1990s, the European Community recognized the need to control the use of pesticides that could harm human health and the environment. The community is working towards the establishment of a comprehensive network of protected areas in all regions of the community. In some countries such as Denmark there were proposals to reduce the use of pesticides drastically. The 1986 Danish Action Plan to reduce pesticide application called for a 50 per cent reduction in pesticide use by the mid 1990s compared to pesticide use in the period 1981-1985.

3.1 Integrated Pest Management (IPM)

Integrated Pest Management (IPM) strategy is a more natural, effective, economical, protective of both public health and the environment and less ecosystem disruptive method to control pests without heavily relying on chemical pesticides. It combines several benign pest control techniques such as the use of natural predators, biological pesticides and adapted cultural practices, including breeding plants for pest and disease resistance with a diminished and less frequent utilisation of chemical pesticides. IPM is based on the idea that below a certain pest population density or economic threshold, the cost of control measures exceeds the value of losses from pests. To determine the economic threshold, information is needed on the extent of a pest attack; the damage function, relating the level of attack to crop loss; the control function, relating the reduction in attack to the control strategy applied; the estimated crop price; and the cost of the control strategy and its application.

Three IPM programmes have been very successful in pest management: rice in Indonesia, cassava in Africa and Soybeans in Brazil. In Kenya too, some work has been done on IPM research and biological and cultural control measures on coffee and a resistant coffee variety has been developed. In Egypt, IPM on cotton was successfully developed since the mid-80s. However, despite its advantages, IPM has not been widely adopted. In many developing countries farmers do not adopt IPM readily because it is a demanding control measure. Because IPM is labour intensive, it would also be less attractive in high-wage areas.

3.2 *Pest Management Efforts in Asia and the Pacific*

One major step towards better pest management in the region was the establishment of the "FAO Intercountry Program for Integrated Pest Control in Rice in South and Southeast Asia" (an IPM Demonstration and training program) since the early 1980s. By 1992, 4 lakh farmers and 40,000 extension workers were trained in IPM. This resulted in reduction of pesticide use with subsequent reductions in government subsidies on pesticides amounting to over $150 million and farmers' savings on pesticide purchases over $15 million. At the same time rice production was said to have increased by as much as 5 per cent annually, though not all of which should be attributed to improved pest management. In parallel, a 'GIFAP Safe Pesticide Use Project' was inaugurated for improving pesticide use standards.

3.3 *Pesticide Subsidy Policy in Pakistan*

In the 1950s Pakistan received large quantities of pesticides from USAID and other donors, along with spraying equipment, and distributed these free or with heavy subsidies to the farmers. The central government also carried on an aerial spraying programme. It did more harm than good. Above all it killed the initiative of farmers and their participation in plant protection activities. (Repetto, 1985).

In the 1980s Evaluation Committees found this system of government spraying and subsidised farm sales highly inefficient. Procurement of chemicals proceeded on the basis of acreage targets without regard to need or use, resulting in excessive inventory build-ups and wastage of materials. Spraying was carried out carelessly and the use of pesticides was often excessive and inefficient. In 1980, the government announced a new agricultural policy, which among other things, removed pesticides price subsidies, stopped government spraying of crops and transferred the trade to the private sector without price regulations.

Stopping of aerial spraying did not produce any adverse effects. Pest scouting operations carried out in cotton and paddy fields showed that there was no need for aerial spraying in the first place. (Repetto, 1985). Eliminating subsidies and routine distribution at first resulted in a marked reduction in sales, as stocks were reduced and private distributors began to assess the market. Since 1981, consumption has picked up, as private companies have established credit sales, distribution networks and farm demand for new products.

Withdrawal of the subsidy has made the farmers more judicious in the choice and use of pesticides. Only effective and less expensive chemicals are finding favour with them. Wastage has been considerably reduced.

3.4 Biotechnology

Unlike chemical technology – which in the long run degrades soil, is highly pollution intensive and has other adverse side effects – biotechnology uses micro organisms that fight other micro organisms and pests that are harmful to the plant. This does not pollute the air, water and soil, the way chemical substitutes do. Bio-technology and genetic engineering have the potential to introduce crops that could withstand drought conditions, soil salinity, toxicity, etc. In the long run, bio-technology may bring down the use of fertiliser and chemical pesticides, by developing plants that can fix nitrogen and which are resistant to pests and diseases.

While the conventional techniques based on high yielding varieties are scale neutral as they can be used by farmers irrespective of size of holdings, they are not resource neutral. Bio-technology can infuse a dimension of resource neutrality along with scale neutrality in farming mechanisms and can help to achieve greatest efficiency of the plant to extract and utilise nutrients from the soil and to improve energy allocation efficiency.

In India, research work in bio-technology is yet to gain momentum, although a task force have been constituted by the Government to support scientific exploration in the following fields:

(a) Development of stress resistant plant species for higher yields with less inputs.

(b) Transgenic crop plants for higher yields, pest management etc.

(c) Development of biological pesticides using bio-technological tools so as to bring down the pollution load of chemical pesticides.

(d) Development of cost effective bio-fertilisers.

Recently, India has started some venture capital firms like Bio-tech Consortium and Risk Finance Corporation.

3.5 *Other Measures*

According to Farah (1994), much of the pesticide misuse in Africa is due to the farmer's inadequate knowledge base, a problem which could be overcome by training.

Efforts to educate farmers regarding the safe and efficient use of pesticides are being undertaken in some countries. For example, the Washington State Department of Agriculture (WSDA) has maintained a farm worker education program since 1990. The program's goal is to protect Hispanic pesticide users and agricultural workers from hazardous exposure to pesticides. Through pesticide, pre-license classes and other outreach activities, over twelve thousand farmworkers have been trained on how to work safely around pesticides and their residues.

A Farmer Education Advisory Committee was formed including foremen, crop advisors, farmers, WSU extension agents, trainers and other industry representatives to work co-operatively with the farming community. Hands-on workshops are operated where participants are instructed on first-aid, personal protective equipment, mixing and loading, and clean-up and disposal.

Also, a pilot programme funded by the Pacific Northeast Agricultural Safety and Health Centre and conducted by the Centre for Farm Health and Safety at Eastern Washington University aims at providing health education and farm safety training to Hispanic farm workers in the Lower Columbia Basin, Yakima Valley, and Walla Walla areas. Issues addressed by the programme include how chemicals can affect the health of workers and their families. It explains how individuals can protect themselves and their families at work and at home by using personal protective equipment, using proper laundering practices for clothes exposed to pesticides, and practising good personal hygiene. It discusses the symptoms of exposure, as well as how to report an exposure and what workers need to know when they visit the doctor or clinic.

Further, the Federal Insecticide Fungicide and Rodenticide Act (FIFRA) as well as Washington State regulations prescribe the language to be used on the label and for use directions. FIFRA states "It shall be unlawful for any person to use any registered pesticide in a manner inconsistent with its labeling guidelines...." This language is mirrored in the Washington Pesticide Control Act which states "It shall be unlawful for any person to use... any pesticide contrary to label directions....". EPA studies the use patterns described on proposed product labels to determine if registration shall be granted and whether use as per the label directions will (or won't) be protective of human health and the environment. In Washington State, the group responsible for enforcing label direction adherence is the compliance branch of WSDA's Pesticide Management Division. Provisions also exist for EPA involvement.

WSDA issues a "Notice of Correction" to first time offenders in pesticide cases. Less frequently WSDA moves directly to a civil penalty in cases where State laws allow WSDA to levy penalties up to $7,500 per violation. Often, such information comes from the records that applicators are required to keep. These records are reviewed in the process of conducting an investigation and they may show something like an application rate of one quart per acre when the label calls for one pint. Statements taken from the parties involved in an incident can also provide documentation of an illegal application. Application to the wrong crop is often picked up because of phytotoxic effects. Finally, residue testing may reveal that a pesticide has been misapplied or has drifted onto a crop for which it is not labeled.

Steps are also taken to ensure safe disposal of empty pesticide containers. Washington Pest Consultants Association organises an annual series of collection dates and sites for empty pesticide containers.

Cote d'Ivoire and Senegal in Africa also has pesticide analytical laboratories for pesticide residue analysis. In Pakistan, a pesticide analysis laboratory at the Agricultural Research Institute undertakes residue monitoring. Brazil has 26 poison centres to monitor and treat all cases of poisoning, including those that are pesticide induced. Indonesia, China and also Sri Lanka, with the collaboration of FAO, in the mid 1990s, started a programme to train farmers in IPM technology on rice. In Chile, local NGOs have developed training programs on the safe use, disposal, handling, transportation and storage of pesticides at the distributor and farmer levels. In Colombia, large multinational pesticide companies have farmer training programmes for the safe and effective use of pesticides.

4 Controlling Water Pollution

The United States Geological Service (USGS) through research and surveys, linked high nitrate concentrations in surface and groundwater to areas predominated by agricultural land use. The principal finding of USGS (1999) regarding surface water quality was that there has been an increase in sediment loading. Sediment loading has been recognised as a serious problem in central Washington. The largest problem is associated with a specific type of irrigation system: furrow irrigation. The USGS recognises that improvement in water management with centre pivot and drip type irrigation systems has the potential to decrease sediment load to surface water as well as to decrease nutrient and pesticide movement to ground water. Prototype systems for further refining these technologies through variable rate water application in centre pivots offer potential for further improvements in water management that has both economic (production) and environmental implications. Alternative management strategies such as variable rate agri-chemical applications and cover crop use for soil surface and nutrient management are being studied by researchers and readily adapted by some growers. The findings also recognise that the use of polyacrylamide (PAM) in furrow irrigation systems helps to reduce sediment loading. In the past five years, use of PAM has increased, and this trend is expected to continue. The changes in irrigation water management systems away from furrow are also continuing. The Franklin Conservation District estimates that in Franklin County (one of the counties in the study area) the furrow-irrigated acreage has decreased from about 15 per cent in 1986 to about 7 per cent in 1999 which means lower surface water contamination with sediment.

Various programmes to protect water quality and wildlife habitat have been initiated in the US. For instance, Washington State has listed salmon as an endangered species and regards the need to restore and enhance riparian buffers on agricultural land along all salmon bearing and potential salmon bearing water bodies in the State, to develop more fish friendly streams while also allowing agricultural production. Riparian buffers on agricultural land are important to salmon recovery because they create shade to lower water temperature; improve water quality by reducing sediments; become a source of woody debris that create pools; stabilise stream banks; and reduce chemical and nutrient run-off, such as fecal coliform.

The Conservation Reserve Enhancement Program (CREP) is one program that has received a lot of media attention. CREP is a new, voluntary, incentive-based program for farmers and ranchers to establish riparian habitat along spawning areas for salmon and steelhead stocks. In return for planting and maintaining the buffer strips for the length of the contract (10-15 years), farmers will receive rental payments for this idled land from the Natural Resource Conservation Service.

ASSESSMENT AND CONCLUSION 5

1. Assessment

Environmental degradation may result from both market failures and policy failures. Policy instruments for containing environmental degradation within acceptable thresholds have mainly focused on market failures. Fiscal instruments aim to address market failures such as externalities, poorly defined or absent property rights and absence of pricing or inadequate pricing of environmental resources through either direct or market oriented mechanisms. However, when economic policy leads to the use of such fiscal instruments as subsidies which themselves become a cause of environmental degradation, these may be cited as instances of policy failures. Several instances of environmentally detrimental subsidies that are introduced as part of a conscious economic policy may be cited. For example, subsidisation of agriculture through subsidisation of water, electricity or fertiliser lead to improper use and overuse of these resources. These have detrimental consequences for the natural resources, human health, and human welfare.

Conventional economic analysis obscures the degradation of the natural resource base that supports the economy including the agriculture of a country. Changes in the productivity and availability of natural resources simply are not taken into account. Economic research documenting the relationship between farm practices and environmental degradation is scanty.

Unsustainable agricultural practices can generate harmful impacts for the environment. However, many of these impacts are not confined to the agricultural sector; nor are these typically accounted for in farmers' cost and revenue functions. These environmental effects depend on: the amount and composition of agricultural production; which inputs are used; farm practices employed; and site specific natural conditions - many of which are influenced by the type of policy intervention that is made. The essential explanation for these environmental impacts is that markets neither penalise farmers for them, nor offer rewards for avoiding or reducing them. The problem are compounded when government interventions encourage a commodity mix narrower than would be the case if output support prices were not in favour of certain crops, and prompt high levels of water, fertilizer and chemical use.

Harmful environmental impact on agriculture is attributed, to a large extent, to government subsidies to agricultural inputs which encourage improper and excessive use of these inputs which, in turn, has implications for the quality and availability of natural resources. This is not to say that all subsidies are bad and they can not serve any useful purpose. There are many instances, where subsidies can benefit the environment. Such subsidies include subsidies for reforestation projects, and for encouraging farming techniques or crops which raise soil fertility. Similarly, expenditures on wetland protection and subsidies to encourage environment friendly technologies are beneficial to the environment.

The Indian scenario in paying attention to environment today seems mixed. On the one hand, we have states investing in agricultural input subsidies for short-term increases in agricultural output, which may potentially harm agriculture itself through a degeneration of the environment in the longer run. On the other hand, we also find that adequate environmental protection is missing in states where it is most desirable. The environmental problems of the country today call for appropriate and reliable data generation, which would help in truly analysing the existing conditions and in framing related directives and policies.

2. Conclusions

Subsidy calculations of Chapter 2, reveal certain facts about the environment related budgetary subsidies in India. Subsidies identified as having a bearing on environment, account for less than 1 percent of the GDP, Centre and States considered together. Of these, subsidies having a clear positive impact on environment are only a small fraction. Division of subsidies between centre and states shows that environment related subsidies emanate relatively more from the state budgets. Centre has a higher share in some of the Group B subsidies. Inter-state comparisons of per capita environment-related subsidies broadly indicate that:

(a) per capita subsidy is higher for states with higher per capita incomes; and

(b) a substantial share of environmental related subsidies pertain to irrigation.

A profile of recovery rates for environment related subsidies across states shows that the north-eastern states like Mizoram, Assam and Sikkim and also the hilly state of Jammu and Kashmir have extremely low recovery rates.

Subsidies relating to major and medium irrigation, minor irrigation and soil and water conservation had the largest share in environment-related subsidies for most states.

A positive relationship is seen when per capita revenue expenditure on environment promoting schemes is plotted against per capita income of the states indicating that the propensity of a state to invest in environmental subsidies depends largely on financial condition of the state.

The analytical framework presented in Chapter 3 allows to identify the impact of input use on environmental quality and crop yield. The model incorporates the environmental variables directly into the farm production function. The strength of the framework lies in its straight forward applicability. From the framework, environmentally optimal levels of input use can be identified which also serve to derive the input price changes needed in order to move the farmers towards the social optimum.

The issue is also addressed as an optimal control problem to obtain a price structure for the given input that will address the problem of overuse and will be environmentally optimal. This is done for nitrogenous fertilisers where the control variable for the social planner is the price of fertiliser. It is shown that given the initial nitrogen fixed in the system N_o, the environmentally optimal solution is to choose an initial price P_0 such that the ordered pair (N_0, P_0) lies on a stable branch, then the dynamic forces of the model, represented by the solution of simultaneous equation system, lead to an intertemporal equilibrium. This gives the environmentally optimal price of nitrogen fertiliser $\overline{P}$, and the stable branches give the environmentally optimal time path of the nitrogen price. If the system is not on one of the stable branches, the dynamic forces of the model lead into a situation of either (i) ever increasing N accompanied by ever decreasing P, or (ii) ever increasing P accompanied by ever decreasing N. Clearly, none of these is sustainable.

Apart from increasing environmental awareness, correct pricing of environmental resources needs to be brought about and sustainable agriculture encouraged. The fact that environmental resources cannot be exploited indefinitely needs to be realised and steps need to be taken to ensure their optimal usage. Distortionary and environmentally harmful subsidies should be reduced appropriately so as to curb their harmful effects on the environment. For this, the cost of the environmental resources has to be incorporated in the market price of the agricultural input to induce its correct usage. The revenue that would be generated from such a policy would be two-fold: first, through the reduction of the subsidy itself, and secondly, via the increased market price.

Subsidisation programmes should not be thought of as static exercises. Rather they should respond to their past history and the user charges that are levied in the concerned sector. Viewing subsidies in terms of a life cycle where they may grow in importance initially or in an expansion phase, reach a maximum and then are rolled back in the contraction phase may be the best method of promoting relevant objectives in a sector. When appropriate changes do not take place in response to the history of the subsidy and the external environment, the expansion phase may be over stated and contraction may prove to be very difficult. Subsidy programmes that are not scrutinised with respect to their desired life cycle pattern may prove to be more harmful than beneficial. Recognising a suitable life cycle is especially important in the context of environment.

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Appendix 1

Estimating Budgetary Subsidies: Notes on Methodology

Estimation methodology is based on Srivastava and Sen, *et. al.* (1997) and Srivastava and Amar Nath (2001). The main steps are described below.

Subsidies are measured here as "unrecovered" costs of governmental provision of the relevant goods/services. The unrecovered costs are measured as the excess of aggregate costs over receipts from the concerned budgetary head. The aggregate costs consists of two elements: (i) current costs (RX); (ii) annualised capital costs. There are three forms of government investment resulting into accumulated capital stock. If services are departmentally provided, there is investment in physical capital. In addition, there is investment in the form of equity and loans including those given to public enterprises. The annualised cost of capital is obtained by applying the interest rate at which funds have been borrowed by the government. This is calculated by dividing interest payments in the reference year by outstanding debt at the beginning of the year. In the case of physical capital, a depreciation cost is calculated in addition. The receipts come in three forms: revenue receipts from the user charges, interest receipts on loans, and dividends on equity investment.

In terms of symbols, these costs are:

$$C = RX + (i + d^*) K_o + iZ_o$$

where

RX = revenue expenditure (adjusted for transfers to and from funds) on the service head
i = effective interest rate
d* = depreciation rate
K_o = aggregate capital expenditure at the beginning of the period
Z_o = sum of loans and equity investment at the beginning of the period

Receipts are:

$$R = RR + (I + D)$$

where

RR = revenue receipts
I = interest receipts
D = dividends

Subsidy is defined as: $S = C - R$

The depreciation rate is to be calculated with reference to the stock of capital at the beginning of the year. This stock of capital is the sum of nominal investments in previous years. Since these are additions of nominal figures, all at different prices, the calculation of depreciation rate has to take this into account. The methodology used for this purpose is explained below.

Let the life of a capital asset be T years. The rate of depreciation would be (1/T) per year for the asset to be written off. For example, if T = 50 (years), 1/T = .02. Let the current year be T + 1. The past years under consideration are from 1 to T. Let nominal investments in these years be written as

$$I_1, I_2, \ldots.., I_T$$

Assuming an investment growth rate of z, we have

$$I_2 = (1 + z)\, I_1$$

$$I_T = (1 + z)^{T-1}\, I_1$$

Thus,

$$I_1 = I_T/(1 + z)^{T-1}$$

Correspondingly,

$$I_1 = I_T/(1 + z)^{T-1}$$

$$I_2 = I_T/(1 + z)^{T-2}$$

$$I_{T-1} = I_T/(1 + z)$$

$$I_T = I_T$$

If the long-term rate of inflation is `i', a nominal amount of 1 in year 1, is $(1 + i)^{T-1}$ in terms of the prices of the T_{th} year.

Then, the sum of I_1, etc., in terms of the prices of the T_{th} year can be written as

$$I_T\left(\frac{1+i}{1+z}\right)^{T-1} + I_T\left(\frac{1+i}{1+z}\right)^{T-2} + \ldots\ I_T$$

$$= I_T\,[w^{T-1} + w^{T-2} + \ldots.. + 1]$$

where

$$w = \left(\frac{1 + i}{1 + z}\right)$$

Let, $K_T = (I_T + I_{T-1} + ... + I_1)$ indicate aggregate capital expenditure obtained by summing investments measured in the prices of the respective years in which they were made. We can write:

$$K_T = I_T + \frac{I_T}{(1 + z)} + ... + \frac{I_T}{(1 + z)^{T-1}}$$

$$= I_T\left[1 + \left(\frac{1}{1 + z}\right) + ... + \left(\frac{1}{1 + z}\right)^{T-1}\right]$$

$$= I_T\,[1 + x + ... + (x)^{T-1}]$$

where

$$x = 1/(1 + z)$$

or

$$I_T = K_T/(1 + x + ... + x^{T-1})$$

Depreciation for one year in terms of the prices of year T is given by

$$= \left(\frac{1}{T}\right) I_T\,(1 + w + w^2 + ... + w^{T-1})$$

$$= \left(\frac{1}{T}\right) K_T\,\frac{(1 + w + w^2 + ... + w^{T-1})}{(1 + x + ... + x^{T-1})}$$

Depreciation in terms of prices of year (T + 1), i.e., the current year, can be obtained by multiplying the above expression further by (1 + i). Thus, if K_T (i.e., outstanding accumulated capital stock in nominal terms) is to be used as the base, the depreciation rate on this should be

$$\left(\frac{1}{T}\right)\left(\frac{1 + w + w^2 + ... + w^{T-1}}{1 + x + x^2 + ... + x^{T-1}}\right)(1 + i)$$

By simulating with alternative values of parameters (i, z) the following features regarding the impact of changes in the parameters on the depreciation rate can be derived.

i. The higher is the inflation rate, the higher is the depreciation rate, for any given rate of growth of investment.

ii. The higher is the investment growth rate, the lower is the depreciation rate for any given inflation rate.

Appendix 2

Limitations of the Methodology for Estimating Budgetary Subsidies

It may be noted that there are certain important assumptions and qualifications characterising the methodology for estimating budgetary subsidies which has been used in this study. In particular, the following may be noted.

1. In estimating subsidies, tax expenditures which arise due to tax incentives and other concessions are not taken into account.
2. Subsidies are budgetary subsidies. Cross-subsidies due to administered price structures are not estimated.
3. Subsidies that are implicit in market prices of such goods/services as higher, technical, or medical education which would prevail in the absence of regulated prices as compared to the actual (administered) prices are not estimated.
4. Opportunity costs on equity or loans that arise because losses can be accumulated in the capital base for calculating returns for any current year are not taken into account. Accrued costs relate to the actual accumulated capital.
5. Average life of assets is assumed to be 50 years. Many assets depreciate faster. A differentiated age structure according to type of assets for estimating depreciation, is not taken into account.
6. Cost is not decomposed between costs at efficient performance levels and residual (inefficiency) costs.
7. Costs and benefits are financial costs; social costs or returns, or secondary and subsequent round effects affecting costs and benefits arising from inter-sectoral linkages are not taken into account.
8. Non-availability of services for initial years where capital is under construction is not taken into account.

It may also be noted that some modifications regarding assumptions of earlier studies like Mundle and Rao (1991), Tiwari (1996) and Srivastava and Sen (1997) have been incorporated. In particular, subsidy sectors and surplus sectors have been separated at the major head level. Further, depreciation rate has been calculated after modifying the methodology so that the problem of summing capital expenditure of varying vintages reflecting different values of the Rupee is taken into account.

For further discussion of the issue involved in the general methodology of estimating budgetary subsidies, the following sources may also be consulted.

Mundle, Sudipto M. Govinda Rao (1991), The Volume and Composition of Government Subsidies in India: 1987-88, Current Policy Issues No. 13, December, National Institute of Public Finance and Police, New Delhi and in *Economic and Political Weekly*, May 4, 1992.

Srivastava, D.K.., Tapas K. Sen, et.al. (1997), *Government Subsidies in India*, National Institute of Public Finance and Policy, August, New Delhi.

Srivastava, D.K., and H.K. Amar Nath (2001), *Central Budgetary Subsidies in India*, National Institute of Public Finance and Policy, New Delhi.

Srivastava, D.K.., and C. Bhujanga Rao (2001), Subsidies: Issues and Approach presented in the World Bank-NIPFP conference on **Fiscal Polices to Accelerate Economic Growth** held on May 21-22, 2001, New Delhi.

Appendix 3.1: Estimating Environmental Related Budgetary Subsidies: 1994-95 to 1996-97

India (states and centre)

Units in Rs lakh and Recvy. rate in %

INDIA (states and centre)			1994-95		effec. int. rate				
Parameters :					*11.42*				
Description	**Rev Rec.**	**Rev Exp.**	**Div.**	**Int.on loans**	**Annualised Cost of Cap.***	**Total Costs**	**Total Rec.**	**Subsidy**	**Recvy. rate**
Sewerage & Sanitation	0.48	4078.06			122.27	4200.33	0.48	4199.85	0.01
Soil and Water Conservation		1917.93			126.91	2044.84		2044.84	
Fisheries	247.52	3835.28			2528.51	6363.79	247.52	6116.27	3.89
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		1556.71			284.38	1841.09		1841.09	
Environ. Forestry and Wildlife	5614.62	1475.32			15.61	1490.93	5614.62	-4123.69	376.58
Agri. Research and Education		5220.00				5220.00		5220.00	
Special Areas Dev Prog.		62.62				62.62		62.62	
Major and Medium Irrigation	451.18	5578.68			2026.66	7605.34	451.18	7154.16	5.93
Minor Irrigation	76.72	5454.33			60.91	5515.24	76.72	5438.52	1.39
Command Area Dev Prog.		146.47			248.46	394.93		394.93	
Flood Control and Drainage		2948.81			344.45	3293.26		3293.26	
Non-Conv. Sources of Energy	1.24	13837.17			898.33	14735.50	1.24	14734.26	0.01
Fertiliser	0.01	407500.00	5.38		71825.21	479325.21	5.39	479319.82	0.00
Pesticide and Chemicals		-1186.38			7563.71	6377.33		6377.33	
Total	6391.77	452425.00	5.38		86045.41	538470.41	6397.15	532073.26	1.19
INDIA (states and centre)			1995-96						
Parameters :					*17.09*				
Sewerage & Sanitation	0.41	4280.02			369.60	4649.62	0.41	4649.21	0.01
Soil and Water Conservation		2102.34			179.56	2281.90		2281.90	
Fisheries	282.44	3714.84			3703.34	7418.18	282.44	7135.74	3.81
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		1691.21			396.09	2087.30		2087.30	
Environ. Forestry and Wildlife	1409.85	1492.59			31.00	1523.59	1409.85	113.74	92.53
Agri. Research and Education		5668.00				5668.00		5668.00	
Soil and Water Conservation									
Fisheries									
Forestry									
Special Areas Dev Prog.		26319.36				26319.36		26319.36	
DPAP/Desert Development Prog.									
Wasteland Development Prog.									
Major and Medium Irrigation	295.27	6926.85			3003.34	9930.19	295.27	9634.92	2.97
Minor Irrigation	51.18	5359.46			158.42	5517.88	51.18	5466.70	0.93
Command Area Dev Prog.		194.39			368.87	563.26		563.26	
Flood Control and Drainage		4339.41			518.73	4858.14		4858.14	
Flood Control									
Anti-Sea Erosion									
Non-Conv. Sources of Energy	3.79	11822.06			1544.67	13366.73	3.79	13362.94	0.03
Fertiliser	0.45	430738.87	7.98		106180.63	536919.50	8.43	536911.07	0.00
Pesticide and Chemicals		8611.85			10239.09	18850.94		18850.94	
Total	2043.39	513261.25	7.98		126693.34	639954.59	2051.37	637903.22	0.32
INDIA (states and centre)			1996-97						
Parameters :					*12.19*				
Sewerage & Sanitation		1353.98			356.07	1710.05		1710.05	
Soil and Water Conservation		2170.48			143.50	2313.98		2313.98	
Fisheries	264.08	3162.39			2871.53	6033.92	264.08	5769.84	4.38
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		1762.74			337.21	2099.95		2099.95	
Environ. Forestry and Wildlife	89.38	1616.18			28.38	1644.56	89.38	1555.18	5.43
Agri. Research and Education		5696.00				5696.00		5696.00	
Soil and Water Conservation									
Fisheries									
Forestry									
Special Areas Dev Prog.		22465.96				22465.96		22465.96	
DPAP/Desert Development Prog.									
Wasteland Development Prog.									
Major and Medium Irrigation	389.21	7289.15			2339.25	9628.40	389.21	9239.19	4.04
Minor Irrigation	79.49	6804.24			192.59	6996.83	79.49	6917.34	1.14
Command Area Dev Prog.		240.33			265.43	505.76		505.76	
Flood Control and Drainage		6045.99			537.16	6583.15		6583.15	
Flood Control									
Anti-Sea Erosion									
Non-Conv. Sources of Energy	8.56	12813.76	0.20	720.86	2139.55	14953.31	729.62	14223.69	4.88
Fertiliser	0.05	474300.00	4.05	5192.87	89591.38	563891.38	5196.97	558694.41	0.92
Pesticide and Chemicals		1416.11			7937.94	9354.05		9354.05	
Total	830.77	547137.31	4.25	5913.73	106740.00	653877.31	6748.75	647128.56	1.03

Basic Source: *Finance Accounts*

*including imputed interest on investment

Notes as in Table A1.

Appendix 3.2: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Andhra Pradesh

Units in Rs lakh and Recvy. rate in %

ANDHRA PRADESH				1994-95	effec. int. rate 11.34				
Description	**Rev Rec.**	**Rev Exp.**	**Div.**	**Int.on loans**	**Annualised Cost of Cap.***	**Total Costs**	**Total Rec.**	**Subsidy**	**Recvy. rate**
Parameters :									
Sewerage & Sanitation	481.02	2188.31			110.79	2299.10	481.02	1818.08	20.92
Soil and Water Conservation		1415.06			86.11	1501.17		1501.17	
Fisheries	149.25	1059.76		13.01	823.16	1882.92	162.26	1720.66	8.62
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		1223.46			282.09	1505.55		1505.55	
Environ. Forestry and Wildlife	1.48	961.34			8.88	970.22	1.48	968.74	0.15
Agri. Research and Education									
Special Areas Dev Prog.		2004.11				2004.11		2004.11	
Flood Control and Drainage		143.04			646.41	789.45		789.45	
Non-Conv. Sources of Energy	0.02	75.00			1.52	76.52	0.02	76.50	0.02
Total A	***631.77***	***9070.08***	***0.00***	***13.01***	1958.95	***11029.04***	***644.78***	***10384.25***	***5.85***
Major and Medium Irrigation	10380.48	61377.56			71793.68	133171.24	10380.48	122790.76	7.79
Minor Irrigation	813.54	5141.56		0.48	-8485.05	-3343.49	814.02	-4157.51	-24.35
Command Area Dev Prog.		470.82			1761.26	2232.08		2232.08	
Total B	***11194.02***	***66989.94***	***0.00***	***0.48***	65069.89	***132059.83***	***11194.51***	***120865.32***	***8.48***
Total	11825.79	76060.02		13.49	67028.84	143088.86	11839.29	131249.58	8.27
ANDHRA PRADESH				1995-96					
Parameters :					***11.75***				
Sewerage & Sanitation	366.36	1573.58			114.57	1688.16	366.36	1321.79	21.70
Soil and Water Conservation		1598.65			89.18	1687.83		1687.83	
Fisheries	207.91	1162.38		59.86	887.16	2049.55	267.77	1781.78	13.06
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		2790.98			371.66	3162.64		3162.64	
Environ. Forestry and Wildlife	71.24	1043.59			11.00	1054.59	71.24	983.35	6.76
Agri. Research and Education									
Special Areas Dev Prog.		1593.22				1593.22		1593.22	
Flood Control and Drainage		113.78			702.52	816.30		816.30	
Non-Conv. Sources of Energy	0.00	202.22			1.55	203.77	0.00	203.77	0.00
Total A	***645.51***	***10078.40***	***0.00***	***59.86***	2177.54	***12256.04***	***705.37***	***11550.67***	***5.76***
Major and Medium Irrigation	9461.23	71182.28			83848.60	155030.88	9461.23	145569.65	6.10
Minor Irrigation	739.95	6070.94		0.01	915.63	6986.58	739.96	6246.62	10.59
Command Area Dev Prog.		501.07			2209.98	2711.05		2711.05	
Total B	***10201.18***	***77754.30***	***0.00***	***0.01***	86974.21	***164728.51***	***10201.18***	***154527.33***	***6.19***
Total	10846.69	87832.71		59.87	89151.85	176984.56	10906.55	166078.00	6.16
ANDHRA PRADESH				1996-97					
Parameters :					***12.12***				
Sewerage & Sanitation	515.10	1451.29			117.97	1569.27	515.10	1054.16	32.82
Soil and Water Conservation		1883.36			91.98	1975.34		1975.34	
Fisheries	225.25	1230.53		78.07	912.27	2142.80	303.32	1839.48	14.16
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		5767.37			476.64	6244.01		6244.01	
Environ. Forestry and Wildlife	2.67	1043.03			11.23	1054.26	2.67	1051.59	0.25
Agri. Research and Education									
Special Areas Dev Prog.		3567.97				3567.97		3567.97	
Flood Control and Drainage		121.55			827.90	949.45		949.45	
Non-Conv. Sources of Energy	0.00	85.00			1.59	86.59	0.00	86.58	0.00
Total A	***743.02***	***15150.10***	***0.00***	***78.07***	2439.59	***17589.69***	***821.09***	***16768.60***	***4.67***
Major and Medium Irrigation	6476.93	82009.91			95055.90	177065.81	6476.93	170588.87	3.66
Minor Irrigation	696.08	4111.53		0.17	11022.58	15134.10	696.25	14437.86	4.60
Command Area Dev Prog.		512.83			2372.52	2885.36		2885.36	
Total B	***7173.01***	***86634.27***	***0.00***	***0.17***	108451.00	***195085.27***	***7173.18***	***187912.09***	***3.68***
Total	7916.03	101784.36		78.24	110890.59	212674.95	7994.27	204680.68	3.76

Basic Source: *Finance Accounts*

*including imputed interest on investment

Notes as in Table A1.

Appendix 3.3: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Arunachal Pradesh

Units in Rs lakh and Recvy. rate in %

Description	Rev Rec.	Rev Exp.	Div.	Int.on loans	Annualised Cost of Cap.*	Total Costs	Total Rec.	Subsidy	Recvy. rate
ARUNACHAL PRADESH				1994-95	effec. int. rate				
Parameters :					*12.28*				
Sewerage and Sanitation		75.40			6.27	81.67		81.67	
Soil and Water Conservation		803.40			124.03	927.43		927.43	
Fisheries	6.23	216.24			28.64	244.88	6.23	238.65	2.54
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		56.92				56.92		56.92	
Environ. Forestry and Wildlife		454.19				454.19		454.19	
Agri Research and Education									
Special Areas Development Prog.									
Flood Control and Drainage		3.05			135.78	138.84		138.84	
Non-Conventional Sources of Ener	2.49	101.03			1.45	102.47	2.49	99.99	2.43
Total A	***8.71***	***1710.23***	***0.00***	***0.00***	**296.17**	***2006.40***	***8.71***	***1997.69***	***0.43***
Major and Medium Irrigation		50.00			31.99	82.00		82.00	
Minor Irrigation	45.01	1783.25			168.03	1951.29	45.01	1906.28	2.31
Command Areas Development Prog.		41.00				41.00		41.00	
Total B	***45.01***	***1874.25***	***0.00***	***0.00***	**200.03**	***2074.28***	***45.01***	***2029.27***	***2.17***
Total	53.72	3584.49			496.20	4080.69	53.72	4026.96	1.32
ARUNACHAL PRADESH				1995-96					
Parameters :					***11.91***				
Sewerage and Sanitation		68.23			6.14	74.37		74.37	
Soil and Water Conservation		1034.62			134.27	1168.89		1168.89	
Fisheries	7.06	262.54			31.81	294.35	7.06	287.29	2.40
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		42.08				42.08		42.08	
Environ. Forestry and Wildlife		526.02				526.02		526.02	
Agri Research and Education									
Special Areas Development Prog.									
Flood Control and Drainage		1.58			175.82	177.40		177.40	
Non-Conventional Sources of Ener	1.19	109.43			1.41	110.85	1.19	109.66	1.07
Total A	***8.25***	***2044.50***	***0.00***	***0.00***	**349.45**	***2393.95***	***8.25***	***2385.71***	***0.34***
Major and Medium Irrigation		48.25			31.32	79.57		79.57	
Minor Irrigation	27.18	1584.14			179.94	1764.09	27.18	1736.90	1.54
Command Areas Development Prog.		46.71				46.71		46.71	
Total B	***27.18***	***1679.11***	***0.00***	***0.00***	211.26	***1890.37***	***27.18***	***1863.19***	***1.44***
Total	35.43	3723.61			560.71	4284.33	35.43	4248.90	0.83
ARUNACHAL PRADESH				1996-97					
Parameters :					***12.77***				
Sewerage and Sanitation		68.24			6.45	74.69		74.69	
Soil and Water Conservation		825.58			155.38	980.96		980.96	
Fisheries	10.27	278.05			34.75	312.80	10.27	302.53	3.28
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		51.87				51.87		51.87	
Environ. Forestry and Wildlife		562.58				562.58		562.58	
Agri Research and Education									
Special Areas Development Prog.									
Flood Control and Drainage		19.20			242.03	261.23		261.23	
Non-Conventional Sources of Ener	1.41	109.29			1.49	110.78	1.41	109.37	1.28
Total A	***11.68***	***1914.82***	***0.00***	***0.00***	**440.09**	***2354.91***	***11.68***	***2343.23***	***0.50***
Major and Medium Irrigation		93.90			32.88	126.78		126.78	
Minor Irrigation	4.04	1830.20			205.25	2035.45	4.04	2031.42	0.20
Command Areas Development Prog.		87.16				87.16		87.16	
Total B	***4.04***	***2011.25***	***0.00***	***0.00***	**238.13**	***2249.39***	***4.04***	***2245.35***	***0.18***
Total	15.72	3926.07			678.23	4604.30	15.72	4588.58	0.34

Basic Source: *Finance Accounts*

*including imputed interest on investment

Notes as in Table A1.

Appendix 3.4: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Assam

Units in Rs lakh and Recvy. rate in %

ASSAM				1994-95	effec. int. rate				
Parameters :					***14.01***				
Description	**Rev Rec.**	**Rev Exp.**	**Div.**	**Int.on loans**	**Annualised Cost of Cap.***	**Total Costs**	**Total Rec.**	**Subsidy**	**Recvy. rate**
Sewerage & Sanitation		183.60			57.23	240.83		240.83	
Soil and Water Conservation		904.41			92.04	996.44		996.44	
Fisheries	98.07	1004.73			46.85	1051.58	98.07	953.51	9.33
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		883.81			9.30	893.11		893.11	
Environ. Forestry and Wildlife	40.28	840.75				840.75	40.28	800.47	4.79
Agri. Research and Education		212.28			11.55	223.83		223.83	
Special Areas Dev Prog.									
Flood Control and Drainage		3549.38			8935.06	12484.45		12484.45	
Non-Conv. Sources of Energy	2.70	45.05			0.01	45.06	2.70	42.36	5.99
Total A	***141.05***	***7624.01***	***0.00***	***0.00***	**9152.05**	***16776.06***	***141.05***	***16635.01***	***0.84***
Major and Medium Irrigation	16.54	297.20			6179.48	6476.68	16.54	6460.14	0.26
Minor Irrigation	21.39	1213.33			9156.69	10370.03	21.39	10348.64	0.21
Command Area Dev Prog.					1015.54	1015.54		1015.54	
Total B	***37.93***	***1510.54***	***0.00***	***0.00***	16351.71	***17862.25***	***37.93***	***17824.32***	***0.21***
Total	**178.98**	9134.55			**25503.76**	**34638.31**	**178.98**	**34459.33**	**0.52**
ASSAM				1995-96					
Parameters :					***9.82***				
Sewerage & Sanitation		185.48			42.31	227.79		227.79	
Soil and Water Conservation		911.19			70.63	981.82		981.82	
Fisheries	119.33	924.93			40.87	965.80	119.33	846.46	12.36
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		1040.34			7.27	1047.61		1047.61	
Environ. Forestry and Wildlife	58.74	754.88				754.88	58.74	696.14	7.78
Agri. Research and Education		199.51			9.79	209.30		209.30	
Special Areas Dev Prog.									
Flood Control and Drainage		3647.95			7334.66	10982.61		10982.61	
Non-Conv. Sources of Energy	0.00	48.29			0.01	48.30	0.00	48.30	0.01
Total A	***178.08***	***7712.57***	***0.00***	***0.00***	**7505.54**	***15218.11***	***178.08***	***15040.03***	***1.17***
Major and Medium Irrigation	17.37	303.57			5263.10	5566.67	17.37	5549.30	0.31
Minor Irrigation	11.80	1117.42			7949.38	9066.80	11.80	9055.01	0.13
Command Area Dev Prog.					859.07	859.07		859.07	
Total B	***29.17***	***1420.99***	***0.00***	***0.00***	14071.55	***15492.54***	***29.17***	***15463.37***	***0.19***
Total	**207.24**	9133.56			**21577.09**	**30710.65**	**207.24**	**30503.40**	**0.67**
ASSAM				1996-97					
Parameters :					***10.51***				
Sewerage & Sanitation		190.94			48.13	239.06		239.06	
Soil and Water Conservation		957.07			74.16	1031.23		1031.23	
Fisheries	91.22	1124.01			46.09	1170.09	91.22	1078.87	7.80
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		606.15			7.61	613.76		613.76	
Environ. Forestry and Wildlife	57.86	1103.21				1103.21	57.86	1045.35	5.24
Agri. Research and Education		194.87			10.24	205.11		205.11	
Special Areas Dev Prog.									
Flood Control and Drainage		4166.73			7929.86	12096.59		12096.59	
Non-Conv. Sources of Energy		11.84			0.01	11.85		11.85	
Total A	***149.08***	***8354.80***	***0.00***	***0.00***	**8116.09**	***16470.89***	***149.08***	***16321.81***	***0.91***
Major and Medium Irrigation	10.98	348.08			5880.07	6228.16	10.98	6217.18	0.18
Minor Irrigation	9.41	1510.30			9152.98	10663.28	9.41	10653.86	0.09
Command Area Dev Prog.					959.79	959.79		959.79	
Total B	***20.39***	***1858.38***	***0.00***	***0.00***	15992.84	***17851.22***	***20.39***	***17830.83***	***0.11***
Total	169.47	**10213.18**			**24108.93**	34322.12	169.47	**34152.64**	0.49

Basic Source: *Finance Accounts*

*including imputed interest on investment

Notes as in Table A1.

Appendix 3.5: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Bihar

Units in Rs lakh and Recvy. rate in %

BIHAR				1994-95	effec. int. rate				
Parameters :					***11.96***				
Description	**Rev Rec.**	**Rev Exp.**	**Div.**	**Int.on loans**	**Annualised Cost of Cap.***	**Total Costs**	**Total Rec.**	**Subsidy**	**Recvy. rate**
Sewerage & Sanitation		739.22			719.06	1458.27		1458.27	
Soil and Water Conservation		989.05			60.22	1049.26		1049.26	
Fisheries	227.55	709.65			24.52	734.17	227.55	506.62	30.99
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		2173.87			105.32	2279.19		2279.19	
Environ. Forestry and Wildlife		244.74			2.57	247.31		247.31	
Agri. Research and Education		11.29				11.29		11.29	
Special Areas Dev Prog.									
Flood Control and Drainage		2718.39			9049.45	11767.84		11767.84	
Non-Conv. Sources of Energy		315.52				315.52		315.52	
Total A	***227.55***	***7901.73***	***0.00***	***0.00***	**9961.13**	***17862.86***	***227.55***	***17635.31***	***1.27***
Major and Medium Irrigation	1613.37	7406.44			64505.46	71911.90	1613.37	70298.53	2.24
Minor Irrigation	35.75	9338.90			5329.67	14668.57	35.75	14632.82	0.24
Command Area Dev Prog.		1615.92			517.95	2133.87		2133.87	
Total B	***1649.12***	***18361.25***	***0.00***	***0.00***	**70353.09**	***88714.34***	***1649.12***	***87065.22***	***1.86***
Total	**1876.67**	**26262.98**			**80314.22**	**106577.20**	**1876.67**	**104700.53**	1.76
BIHAR				1995-96					
Parameters :					***11.17***				
Sewerage & Sanitation	109.29	639.48			693.92	1333.41	109.29	1224.12	8.20
Soil and Water Conservation		1086.21			57.35	1143.56		1143.56	
Fisheries	319.03	790.86			22.95	813.81	319.03	494.78	39.20
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		2345.05			100.27	2445.32		2445.32	
Environ. Forestry and Wildlife		411.89			2.45	414.34		414.34	
Agri. Research and Education		12.59				12.59		12.59	
Special Areas Dev Prog.		1138.60				1138.60		1138.60	
Flood Control and Drainage		2065.00			9106.97	11171.97		11171.97	
Non-Conv. Sources of Energy		155.04				155.04		155.04	
Total A	***428.32***	***8644.73***	***0.00***	***0.00***	**9983.91**	***18628.64***	***428.32***	***18200.32***	***2.30***
Major and Medium Irrigation	3080.12	8348.72			64023.29	72372.02	3080.12	69291.89	4.26
Minor Irrigation	41.31	10230.79			5128.66	15359.45	41.31	15318.14	0.27
Command Area Dev Prog.		2050.90			483.70	2534.60		2534.60	
Total B	***3121.43***	***20630.42***	***0.00***	***0.00***	**69635.65**	***90266.06***	***3121.43***	***87144.64***	***3.46***
Total	**3549.75**	29275.15			**79619.56**	**108894.71**	3549.75	**105344.96**	**3.26**
BIHAR				1996-97					
Parameters :					***11.49***				
Sewerage & Sanitation		1173.67			709.54	1883.21		1883.21	
Soil and Water Conservation		715.36			58.51	773.87		773.87	
Fisheries	328.50	920.45			23.59	944.04	328.50	615.53	34.80
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		2899.02			102.31	3001.33		3001.33	
Environ. Forestry and Wildlife		366.52			2.50	369.02		369.02	
Agri. Research and Education		18.27				18.27		18.27	
Special Areas Dev Prog.		969.49				969.49		969.49	
Flood Control and Drainage		2366.72			9866.01	12232.73		12232.73	
Non-Conv. Sources of Energy	0.00	284.87				284.87	0.00	284.86	0.00
Total A	***328.50***	***9714.37***	***0.00***	***0.00***	**10762.46**	***20476.83***	***328.50***	***20148.33***	***1.60***
Major and Medium Irrigation	3764.03	10675.56			68387.88	79063.44	3764.03	75299.40	4.76
Minor Irrigation	91.62	12244.88			5266.84	17511.72	91.62	17420.10	0.52
Command Area Dev Prog.		1442.88			497.55	1940.43		1940.43	
Total B	***3855.66***	***24363.31***	***0.00***	***0.00***	74152.27	***98515.59***	***3855.66***	***94659.93***	***3.91***
Total	4184.16	34077.68			84914.74	118992.42	4184.16	114808.26	3.52

Basic Source: *Finance Accounts*
*including imputed interest on investment
Notes as in Table A1.

Appendix 3.6: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Delhi

Units in Rs lakh and Recvy. rate in %

Description	Rev Rec.	Rev Exp.	Div.	Int.on loans	Annualised Cost of Cap.*	Total Costs	Total Rec.	Subsidy	Recvy. rate
DELHI				1994-95	effec. int. rate				
Parameters :									
Sewerage & Sanitation		75.75				75.75		75.75	
Soil and Water Conservation		11.45			0.22	11.67		11.67	
Fisheries	2.37	27.85			5.40	33.25	2.37	30.88	7.13
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		0.15			0.71	0.86		0.86	
Environ. Forestry and Wildlife		45.11				45.11		45.11	
Agri. Research and Education		4.45				4.45		4.45	
Special Areas Dev Prog.									
Flood Control and Drainage		358.06			32.15	390.21		390.21	
Non-Conv. Sources of Energy		104.88				104.88		104.88	
Total A	***2.37***	***627.70***	*0.00*	***0.00***	**38.48**	***666.18***	***2.37***	***663.81***	***0.36***
Major and Medium Irrigation	79.29				3.44	3.44	79.29	-75.85	2308.25
Minor Irrigation	3.65	311.59			75.01	386.60	3.65	382.95	0.94
Command Area Dev Prog.									
Total B	***82.94***	***311.59***	*0.00*	***0.00***	**78.44**	***390.03***	***82.94***	***307.09***	***21.26***
Total	**85.31**	939.29			116.92	**1056.21**	**85.31**	**970.90**	**8.08**
DELHI				1995-96					
Parameters :					***14.98***				
Sewerage & Sanitation		170.00			1793.14	1963.14		1963.14	
Soil and Water Conservation		16.04			0.83	16.87		16.87	
Fisheries	8.96	30.41			21.54	51.95	8.96	42.99	17.25
Forestry and Wildlife									
Forest Cons., Dev., and Regen.					2.73	2.73		2.73	
Environ. Forestry and Wildlife		64.38			39.34	103.72		103.72	
Agri. Research and Education		5.18				5.18		5.18	
Special Areas Dev Prog.									
Flood Control and Drainage		444.80			133.70	578.50		578.50	
Non-Conv. Sources of Energy		148.60				148.60		148.60	
Total A	***8.96***	***879.41***	*0.00*	***0.00***	**1991.28**	***2870.69***	***8.96***	***2861.73***	***0.31***
Major and Medium Irrigation	61.16				13.24	13.24	61.16	-47.92	461.96
Minor Irrigation	2.63	350.26			317.41	667.67	2.63	665.04	0.39
Command Area Dev Prog.									
Total B	***63.79***	***350.26***	*0.00*	***0.00***	**330.65**	***680.91***	***63.79***	***617.12***	***9.37***
Total	72.75	1229.67			**2321.94**	3551.61	72.75	**3478.86**	**2.05**
DELHI				1996-97					
Parameters :					***14.03***				
Sewerage & Sanitation		93.15			2695.50	2788.65		2788.65	
Soil and Water Conservation		19.13			0.79	19.92		19.92	
Fisheries	9.16	33.88			22.07	55.95	9.16	46.79	16.37
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		0.24			3.68	3.92		3.92	
Environ. Forestry and Wildlife		61.50			94.23	155.73		155.73	
Agri. Research and Education		5.55				5.55		5.55	
Special Areas Dev Prog.									
Flood Control and Drainage		403.90			145.44	549.34		549.34	
Non-Conv. Sources of Energy		146.63				146.63		146.63	
Total A	***9.16***	***763.98***	*0.00*	***0.00***	2961.72	***3725.70***	***9.16***	***3716.54***	***0.25***
Major and Medium Irrigation	59.83				12.61	12.61	59.83	-47.22	474.35
Minor Irrigation	1.82	341.86			337.02	678.88	1.82	677.06	0.27
Command Area Dev Prog.									
Total B	***61.65***	***341.86***	*0.00*	***0.00***	349.63	***691.49***	***61.65***	***629.84***	***8.92***
Total	**70.81**	1105.84			3311.36	**4417.20**	**70.81**	**4346.39**	**1.60**

Basic Source: *Finance Accounts*

*including imputed interest on investment

Notes as in Table A1.

Appendix 3.7: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Goa

Units in Rs lakh and Recvy. rate in %

GOA				1994-95	effec. int. rate				
Parameters :					***6.38***				
Description	**Rev Rec.**	**Rev Exp.**	**Div.**	**Int.on loans**	**Annualised Cost of Cap.***	**Total Costs**	**Total Rec.**	**Subsidy**	**Recvy. rate**
Sewerage & Sanitation	20.40	183.23			191.37	374.60	20.40	354.20	5.45
Soil and Water Conservation		39.97			50.91	90.89		90.89	
Fisheries	23.66	199.96		5.09	105.75	305.71	28.76	276.95	9.41
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		71.41				71.41		71.41	
Environ. Forestry and Wildlife		95.25			9.06	104.31		104.31	
Agri. Research and Education		0.08			1.19	1.27		1.27	
Special Areas Dev Prog.									
Flood Control and Drainage		4.09			22.66	26.75		26.75	
Non-Conv. Sources of Energy		11.83				11.83		11.83	
Total A	***44.06***	***605.82***	***0.00***	***5.09***	**380.94**	***986.76***	***49.16***	***937.60***	***4.98***
Major and Medium Irrigation	84.78	277.65		0.02	2467.81	2745.46	84.80	2660.65	3.09
Minor Irrigation	19.80	217.16			334.08	551.25	19.80	531.45	3.59
Command Area Dev Prog.		118.48			160.72	279.21		279.21	
Total B	***104.58***	***613.29***	***0.00***	***0.02***	**2962.62**	***3575.91***	***104.60***	***3471.31***	***2.93***
Total	**148.64**	**1219.11**		**5.11**	**3343.56**	**4562.67**	**153.76**	**4408.91**	**3.37**
GOA				1995-96					
Parameters :					***7.81***				
Sewerage & Sanitation	2.08	315.90			221.59	537.49	2.08	535.42	0.39
Soil and Water Conservation		49.88			60.67	110.55		110.55	
Fisheries	20.46	190.30			124.12	314.42	20.46	293.97	6.51
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		83.49				83.49		83.49	
Environ. Forestry and Wildlife		66.08			10.17	76.25		76.25	
Agri. Research and Education		0.02			4.09	4.11		4.11	
Special Areas Dev Prog.									
Flood Control and Drainage		13.99			27.70	41.69		41.69	
Non-Conv. Sources of Energy		2.82			2.22	5.04		5.04	
Total A	***22.53***	***722.47***	***0.00***	***0.00***	**450.57**	***1173.05***	***22.53***	***1150.52***	***1.92***
Major and Medium Irrigation	47.09	331.90			3150.50	3482.40	47.09	3435.31	1.35
Minor Irrigation	15.54	272.19			408.21	680.40	15.54	664.86	2.28
Command Area Dev Prog.		119.62			190.87	310.49		310.49	
Total B	***62.63***	***723.72***	***0.00***	***0.00***	**3749.58**	***4473.29***	***62.63***	***4410.66***	***1.40***
Total	**85.16**	**1446.19**			**4200.15**	**5646.34**	**85.16**	**5561.18**	**1.51**
GOA				1996-97					
Parameters :					***8.08***				
Sewerage & Sanitation	7.71	242.29			242.12	484.41	7.71	476.70	1.59
Soil and Water Conservation		64.65			65.49	130.14		130.14	
Fisheries	17.84	228.13			129.82	357.96	17.84	340.11	4.98
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		92.37				92.37		92.37	
Environ. Forestry and Wildlife		80.19			10.38	90.57		90.57	
Agri. Research and Education		1.94			6.55	8.49		8.49	
Special Areas Dev Prog.									
Flood Control and Drainage		27.83			30.36	58.19		58.19	
Non-Conv. Sources of Energy		6.62			2.27	8.89		8.89	
Total A	***25.55***	***744.04***	***0.00***	***0.00***	**486.99**	***1231.03***	***25.55***	***1205.48***	***2.08***
Major and Medium Irrigation	34.05	444.85		0.02	3617.25	4062.10	34.07	4028.03	0.84
Minor Irrigation	13.48	399.74			459.48	859.22	13.48	845.73	1.57
Command Area Dev Prog.		164.02			205.32	369.34		369.34	
Total B	***47.53***	***1008.60***	***0.00***	***0.02***	**4282.05**	***5290.65***	***47.55***	***5243.10***	***0.90***
Total	**73.08**	1752.64		**0.02**	**4769.04**	**6521.69**	**73.10**	**6448.58**	1.12

Basic Source: *Finance Accounts*
*including imputed interest on investment
Notes as in Table A1.

Appendix 3.8: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Gujarat

Units in Rs lakh and Recvy. rate in %

Description	Rev Rec.	Rev Exp.	Div.	Int.on loans	Annualised Cost of Cap.*	Total Costs	Total Rec.	Subsidy	Recvy. rate
GUJARAT				1994-95	effec. int. rate				
Parameters :					***11.42***				
Sewerage & Sanitation		1278.61			1.02	1279.63		1279.63	
Soil and Water Conservation		3655.66		0.46	864.36	4520.02	0.46	4519.55	0.01
Fisheries	197.97	1315.12		2.84	323.14	1638.25	200.81	1437.44	12.26
Forestry and Wildlife									
Forest Cons., Dev.. and Regen.		152.29			5757.70	5909.99		5909.99	
Environ. Forestry and Wildlife	10.64	642.15				642.15	10.64	631.51	1.66
Agri. Research and Education		101.61				101.61		101.61	
Special Areas Dev Prog.		1661.12				1661.12		1661.12	
Flood Control and Drainage		484.60			302.93	787.53		787.53	
Non-Conv. Sources of Energy		426.00			1.14	427.14		427.14	
Total A	***208.61***	***9717.16***	***0.00***	***3.30***	**7250.29**	***16967.44***	***211.91***	***16755.53***	***1.25***
Major and Medium Irrigation	4259.04	57728.03			59938.09	117666.12	4259.04	113407.09	3.62
Minor Irrigation	345.31	11698.08			2144.04	13842.12	345.31	13496.81	2.49
Command Area Dev Prog.		1782.58		0.02	0.85	1783.43	0.02	1783.41	0.00
Total B	***4604.35***	***71208.70***	***0.00***	***0.02***	**62082.98**	***133291.68***	***4604.37***	***128687.31***	***3.45***
Total	**4812.96**	**80925.85**		3.32	69333.27	150259.12	**4816.28**	**145442.84**	3.21
GUJARAT				1995-96					
Parameters :					***11.40***				
Sewerage & Sanitation		1499.53			1.02	1500.55		1500.55	
Soil and Water Conservation		3610.74			912.30	4523.04		4523.04	
Fisheries	189.07	1490.43			344.33	1834.75	189.07	1645.68	10.31
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		96.90			6473.60	6570.50		6570.50	
Environ. Forestry and Wildlife	15.75	693.51				693.51	15.75	677.76	2.27
Agri. Research and Education		124.43				124.43		124.43	
Special Areas Dev Prog.		893.53				893.53		893.53	
Flood Control and Drainage		237.17			302.60	539.77		539.77	
Non-Conv. Sources of Energy		327.22			1.00	328.22		328.22	
Total A	***204.82***	***8973.45***	***0.00***	***0.00***	**8034.84**	***17008.29***	***204.82***	***16803.46***	***1.20***
Major and Medium Irrigation	3722.44	73173.94			66337.96	139511.89	3722.44	135789.46	2.67
Minor Irrigation	381.40	12353.48			2619.43	14972.91	381.40	14591.51	2.55
Command Area Dev Prog.		2153.99			0.85	2154.84		2154.84	
Total B	***4103.83***	***87681.41***	***0.00***	***0.00***	**68958.24**	***156639.64***	***4103.83***	***152535.81***	***2.62***
Total	4308.66	96654.86			76993.07	173647.93	4308.66	169339.27	**2.48**
GUJARAT				1996-97					
Parameters :					***12.15***				
Sewerage & Sanitation		1554.89			1.09	1555.97		1555.97	
Soil and Water Conservation		4223.27		0.02	1029.69	5252.95	0.02	5252.93	0.00
Fisheries	233.25	1673.02		2.64	406.12	2079.13	235.88	1843.25	11.35
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		89.47			7678.81	7768.28		7768.28	
Environ. Forestry and Wildlife	18.47	761.36				761.36	18.47	742.89	2.43
Agri. Research and Education		270.65				270.65		270.65	
Special Areas Dev Prog.		849.08				849.08		849.08	
Flood Control and Drainage		366.19			330.51	696.70		696.70	
Non-Conv. Sources of Energy		163.02		0.86	0.91	163.93	0.86	163.07	0.53
Total A	***251.72***	***9950.94***	***0.00***	*3.52*	9447.12	***19398.06***	***255.24***	***19142.82***	***1.32***
Major and Medium Irrigation	3753.58	83466.91			78873.59	162340.51	3753.58	158586.93	2.31
Minor Irrigation	329.95	10560.58			3755.77	14316.34	329.95	13986.40	2.30
Command Area Dev Prog.		2097.66			0.89	2098.55		2098.55	
Total B	***4083.52***	***96125.15***	***0.00***	***0.00***	82630.25	***178755.40***	***4083.52***	***174671.87***	***2.28***
Total	4335.24	106076.09		3.52	92077.37	198153.46	4338.76	193814.70	2.19

Basic Source: *Finance Accounts*

*including imputed interest on investment

Notes as in Table A1.

Appendix 3.9: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Haryana

Units in Rs lakh and Recvy. rate in %

HARYANA				1994-95	effec. int. rate				
Parameters :					***11.56***				
Description	**Rev Rec.**	**Rev Exp.**	**Div.**	**Int.on loans**	**Annualised Cost of Cap.***	**Total Costs**	**Total Rec.**	**Subsidy**	**Recvy. rate**
Sewerage & Sanitation	10.59				255.54	255.54	10.59	244.95	4.14
Soil and Water Conservation		1695.93			22.97	1718.90		1718.90	
Fisheries	58.04	354.86		0.03	11.03	365.88	58.07	307.81	15.87
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		91.24				91.24		91.24	
Environ. Forestry and Wildlife	5.10	144.58				144.58	5.10	139.48	3.53
Agri. Research and Education		19.71				19.71		19.71	
Special Areas Dev Prog.									
Flood Control and Drainage					3749.45	3749.45		3749.45	
Non-Conv. Sources of Energy		46.65				46.65		46.65	
Total A	***73.73***	***2352.97***	***0.00***	***0.03***	**4038.99**	***6391.95***	***73.76***	***6318.20***	***1.15***
Major and Medium Irrigation	1919.19	44041.27			18987.62	63028.89	1919.19	61109.70	3.04
Minor Irrigation	5.52	4720.87			4446.73	9167.60	5.52	9162.07	0.06
Command Area Dev Prog.		3390.76				3390.76		3390.76	
Total B	***1924.71***	***52152.89***	***0.00***	***0.00***	**23434.35**	***75587.24***	***1924.71***	***73662.53***	***2.55***
Total	**1998.44**	**54505.86**		**0.03**	**27473.34**	**81979.20**	**1998.47**	**79980.72**	**2.44**
HARYANA				1995-96					
Parameters :					***11.52***				
Sewerage & Sanitation	14.96				469.91	469.91	14.96	454.95	3.18
Soil and Water Conservation		2339.01			22.91	2361.92		2361.92	
Fisheries	73.71	547.17		0.14	10.84	558.00	73.85	484.15	13.24
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		108.56				108.56		108.56	
Environ. Forestry and Wildlife	3.75	167.48				167.48	3.75	163.73	2.24
Agri. Research and Education		22.86				22.86		22.86	
Special Areas Dev Prog.									
Flood Control and Drainage					3798.30	3798.30		3798.30	
Non-Conv. Sources of Energy		100.98				100.98		100.98	
Total A	***92.42***	***3286.06***	***0.00***	***0.14***	4301.96	***7588.02***	***92.57***	***7495.45***	***1.22***
Major and Medium Irrigation	2100.25	22732.86			19847.98	42580.84	2100.25	40480.59	4.93
Minor Irrigation	5.71	893.50			4947.60	5841.09	5.71	5835.38	0.10
Command Area Dev Prog.		3658.70				3658.70		3658.70	
Total B	***2105.96***	***27285.05***	***0.00***	***0.00***	24795.57	***52080.63***	***2105.96***	***49974.67***	***4.04***
Total	**2198.39**	**30571.11**		**0.14**	**29097.54**	**59668.65**	**2198.53**	**57470.12**	**3.68**
HARYANA				1996-97					
Parameters :					***12.18***				
Sewerage & Sanitation	30.33				771.01	771.01	30.33	740.68	3.93
Soil and Water Conservation		2617.22			23.81	2641.03		2641.03	
Fisheries	137.35	532.85			11.31	544.16	137.35	406.81	25.24
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		110.40				110.40		110.40	
Environ. Forestry and Wildlife	4.86	187.82				187.82	4.86	182.96	2.59
Agri. Research and Education		30.44				30.44		30.44	
Special Areas Dev Prog.		57.92				57.92		57.92	
Flood Control and Drainage					3947.80	3947.80		3947.80	
Non-Conv. Sources of Energy		33.21				33.21		33.21	
Total A	***172.54***	***3569.85***	***0.00***	***0.00***	4753.93	***8323.78***	***172.54***	***8151.24***	***2.07***
Major and Medium Irrigation	2429.96	22638.49			22141.28	44779.78	2429.96	42349.82	5.43
Minor Irrigation	306.48	616.96			5937.72	6554.68	306.48	6248.20	4.68
Command Area Dev Prog.		4645.40				4645.40		4645.40	
Total B	***2736.44***	***27900.85***	***0.00***	***0.00***	28079.01	***55979.86***	***2736.44***	***53243.42***	***4.89***
Total	**2908.98**	**31470.70**			**32832.94**	**64303.64**	**2908.98**	**61394.66**	**4.52**

Basic Source: *Finance Accounts*

*including imputed interest on investment

Notes as in Table A1.

Appendix 3.10: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Himachal Pradesh

Units in Rs lakh and Recvy. rate in %

HIMACHAL PRADESH				1994-95	effec. int. rate				
Parameters :					*11.50*				
Description	**Rev Rec.**	**Rev Exp.**	**Div.**	**Int.on loans**	**Annualised Cost of Cap.***	**Total Costs**	**Total Rec.**	**Subsidy**	**Recvy. rate**
Sewerage & Sanitation		463.64			242.35	705.99		705.99	
Soil and Water Conservation		1841.31		13.78	35.05	1876.35	13.78	1862.58	0.73
Fisheries	63.41	211.54			87.01	298.54	63.41	235.13	21.24
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		550.67			3.35	554.02		554.02	
Environ. Forestry and Wildlife	3.97	236.41			39.45	275.86	3.97	271.89	1.44
Agri. Research and Education		177.62				177.62		177.62	
Special Areas Dev Prog.									
Flood Control and Drainage		20.29			148.89	169.18		169.18	
Non-Conv. Sources of Energy	0.25	164.91				164.91	0.25	164.67	0.15
Total A	***67.63***	***3666.39***	***0.00***	***13.78***	**556.09**	***4222.48***	***81.40***	***4141.08***	***1.93***
Major and Medium Irrigation	0.40	118.60			485.68	604.27	0.40	603.88	0.07
Minor Irrigation	10.48	2443.88			2005.81	4449.68	10.48	4439.20	0.24
Command Area Dev Prog.		25.52			88.14	113.66		113.66	
Total B	***10.88***	***2587.99***	***0.00***	***0.00***	**2579.63**	***5167.62***	***10.88***	***5156.74***	***0.21***
Total	**78.51**	**6254.38**		**13.78**	**3135.72**	**9390.09**	**92.28**	**9297.81**	**0.98**
HIMACHAL PRADESH				1995-96					
Parameters :					*11.64*				
Sewerage & Sanitation		414.61			388.62	803.23		803.23	
Soil and Water Conservation		1922.74		15.35	34.72	1957.46	15.35	1942.11	0.78
Fisheries	62.03	277.89			100.02	377.91	62.03	315.88	16.41
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		650.43			3.38	653.81		653.81	
Environ. Forestry and Wildlife	4.20	241.53			47.83	289.36	4.20	285.16	1.45
Agri. Research and Education		214.92				214.92		214.92	
Special Areas Dev Prog.									
Flood Control and Drainage		39.81			171.85	211.66		211.66	
Non-Conv. Sources of Energy	0.01	340.36				340.36	0.01	340.35	0.00
Total A	***66.24***	***4102.30***	***0.00***	***15.35***	**746.41**	***4848.72***	***81.58***	***4767.13***	***1.68***
Major and Medium Irrigation	0.07	201.26			524.30	725.56	0.07	725.49	0.01
Minor Irrigation	13.02	2525.70			2185.96	4711.66	13.02	4698.64	0.28
Command Area Dev Prog.		32.29			108.58	140.87		140.87	
Total B	***13.09***	***2759.25***	***0.00***	***0.00***	**2818.85**	***5578.10***	***13.09***	***5565.01***	***0.23***
Total	**79.33**	**6861.56**		**15.35**	**3565.26**	**10426.82**	**94.68**	**10332.14**	**0.91**
HIMACHAL PRADESH				1996-97					
Parameters :					*9.85*				
Sewerage & Sanitation		350.33			436.92	787.26		787.26	
Soil and Water Conservation		1844.62		19.79	28.11	1872.73	19.79	1852.94	1.06
Fisheries	77.56	271.72			107.42	379.14	77.56	301.58	20.46
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		613.96			3.02	616.98		616.98	
Environ. Forestry and Wildlife	3.88	253.59			46.60	300.19	3.88	296.31	1.29
Agri. Research and Education		272.58				272.58		272.58	
Special Areas Dev Prog.									
Flood Control and Drainage		42.25			180.12	222.37		222.37	
Non-Conv. Sources of Energy	0.33	328.99				328.99	0.33	328.65	0.10
Total A	***81.78***	***3978.05***	***0.00***	***19.79***	**802.19**	***4780.24***	***101.57***	***4678.67***	***2.12***
Major and Medium Irrigation	0.44	220.79			502.57	723.36	0.44	722.92	0.06
Minor Irrigation	9.14	2695.65			2148.30	4843.96	9.14	4834.82	0.19
Command Area Dev Prog.		18.07			115.44	133.50		133.50	
Total B	***9.58***	***2934.51***	***0.00***	***0.00***	**2766.31**	***5700.82***	***9.58***	***5691.24***	***0.17***
Total	91.35	6912.56		19.79	**3568.51**	**10481.06**	**111.15**	10369.92	1.06

Basic Source: *Finance Accounts*

*including imputed interest on investment

Notes as in Table A1.

Appendix 3.11: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Jammu and Kashmir

Units in Rs lakh and Recvy. rate in %

JAMMU AND KASHMIR				1994-95	effec. int. rate				
Parameters :					***15.12***				
Description	**Rev Rec.**	**Rev Exp.**	**Div.**	**Int.on loans**	**Annualised Cost of Cap.***	**Total Costs**	**Total Rec.**	**Subsidy**	**Recvy. rate**
Sewerage & Sanitation		290.33			480.07	770.40		770.40	
Soil and Water Conservation		1698.21			1716.18	3414.39		3414.39	
Fisheries	10.05	537.36			156.38	693.74	10.05	683.70	1.45
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		965.79			3.54	969.33		969.33	
Environ. Forestry and Wildlife		479.78				479.78		479.78	
Agri. Research and Education									
Special Areas Dev Prog.		2107.62				2107.62		2107.62	
Flood Control and Drainage		1073.46			2360.64	3434.10		3434.10	
Non-Conv. Sources of Energy					-0.03	-0.03		-0.03	
Total A	***10.05***	***7152.55***	***0.00***	***0.00***	4716.79	***11869.33***	***10.05***	***11859.29***	***0.08***
Major and Medium Irrigation	33.14	706.69			4449.98	5156.67	33.14	5123.52	0.64
Minor Irrigation	20.59	3301.77			1610.16	4911.93	20.59	4891.34	0.42
Command Area Dev Prog.		637.57				637.57		637.57	
Total B	***53.73***	***4646.03***	***0.00***	***0.00***	**6060.14**	***10706.17***	***53.73***	***10652.44***	***0.50***
Total	**63.78**	11798.57			**10776.93**	**22575.50**	**63.78**	**22511.72**	**0.28**
JAMMU AND KASHMIR				1995-96					
Parameters :					***8.68***				
Sewerage & Sanitation		376.90			447.11	824.00		824.00	
Soil and Water Conservation		2057.93			1374.13	3432.06		3432.06	
Fisheries	12.65	526.14			124.51	650.65	12.65	638.01	1.94
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		230.19			2.42	232.61		232.61	
Environ. Forestry and Wildlife		840.59				840.59		840.59	
Agri. Research and Education									
Special Areas Dev Prog.									
Flood Control and Drainage					1724.89	1724.89		1724.89	
Non-Conv. Sources of Energy									
Total A	***12.65***	***4031.76***	***0.00***	***0.00***	**3673.06**	***7704.81***	***12.65***	***7692.17***	***0.16***
Major and Medium Irrigation	100.39				3222.24	3222.24	100.39	3121.84	3.12
Minor Irrigation	16.49				1101.03	1101.03	16.49	1084.55	1.50
Command Area Dev Prog.									
Total B	***116.88***	***0.00***	***0.00***	***0.00***	**4323.27**	***4323.27***	***116.88***	***4206.39***	***2.70***
Total	129.53	4031.76			7996.33	**12028.08**	129.53	11898.56	**1.08**
JAMMU AND KASHMIR				1996-97					
Parameters :					***4.04***				
Sewerage & Sanitation		413.59			349.01	762.60		762.60	
Soil and Water Conservation		1782.58			1081.96	2864.54		2864.54	
Fisheries	14.93	677.95			108.42	786.37	14.93	771.44	1.90
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		2002.13			1.62	2003.75		2003.75	
Environ. Forestry and Wildlife		626.74				626.74		626.74	
Agri. Research and Education									
Special Areas Dev Prog.									
Flood Control and Drainage		1495.53			1236.57	2732.09		2732.09	
Non-Conv. Sources of Energy									
Total A	***14.93***	***6998.52***	***0.00***	***0.00***	2777.57	***9776.09***	***14.93***	***9761.16***	***0.15***
Major and Medium Irrigation	53.32	877.30			2281.05	3158.34	53.32	3105.02	1.69
Minor Irrigation	28.16	4942.64			734.53	5677.16	28.16	5649.00	0.50
Command Area Dev Prog.		878.06				878.06		878.06	
Total B	***81.48***	***6698.00***	***0.00***	***0.00***	3015.57	***9713.57***	***81.48***	***9632.09***	***0.84***
Total	96.41	13696.52			5793.14	19489.66	96.41	19393.25	0.49

Basic Source: *Finance Accounts*
*including imputed interest on investment
Notes as in Table A1.

Appendix 3.12: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Karnataka

Units in Rs lakh and Recvy. rate in %

KARNATAKA				1994-95	effec. int. rate				
Parameters :					*11.59*				
Description	**Rev Rec.**	**Rev Exp.**	**Div.**	**Int.on loans**	**Annualised Cost of Cap.***	**Total Costs**	**Total Rec.**	**Subsidy**	**Recvy. rate**
Sewerage & Sanitation		433.89			159.01	592.90		592.90	
Soil and Water Conservation		5373.74			636.71	6010.45		6010.45	
Fisheries	262.32	1540.29			414.82	1955.11	262.32	1692.79	13.42
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		3004.79				3004.79		3004.79	
Environ. Forestry and Wildlife	30.27	1306.24			0.22	1306.46	30.27	1276.19	2.32
Agri. Research and Education									
Special Areas Dev Prog.		1984.66				1984.66		1984.66	
Flood Control and Drainage		8.26			459.39	467.65		467.65	
Non-Conv. Sources of Energy	1.19	1930.91				1930.91	1.19	1929.72	0.06
Total A	***293.78***	***15582.78***	***0.00***	***0.00***	**1670.15**	***17252.93***	***293.78***	***16959.15***	***1.70***
Major and Medium Irrigation	1319.34	29853.67			64173.33	94027.00	1319.34	92707.66	1.40
Minor Irrigation	90.23	5061.62			7178.63	12240.25	90.23	12150.02	0.74
Command Area Dev Prog.		2446.29			39.55	2485.84		2485.84	
Total B	***1409.57***	***37361.58***	***0.00***	***0.00***	71391.51	***108753.10***	***1409.57***	***107343.53***	***1.30***
Total	1703.35	52944.36			73061.66	126006.02	1703.35	124302.68	1.35
KARNATAKA				1995-96					
Parameters :					*11.93*				
Sewerage & Sanitation		424.54			193.58	618.12		618.12	
Soil and Water Conservation		5654.95			684.56	6339.51		6339.51	
Fisheries	262.23	1902.05			467.66	2369.71	262.23	2107.48	11.07
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		3231.74				3231.74		3231.74	
Environ. Forestry and Wildlife	35.79	1399.86			0.22	1400.08	35.79	1364.29	2.56
Agri. Research and Education									
Special Areas Dev Prog.		928.93				928.93		928.93	
Flood Control and Drainage		24.65			615.34	639.99		639.99	
Non-Conv. Sources of Energy	3.65	1330.13				1330.13	3.65	1326.48	0.27
Total A	***301.67***	***14896.86***	***0.00***	***0.00***	**1961.35**	***16858.21***	***301.67***	***16556.54***	***1.79***
Major and Medium Irrigation	1692.87	34388.30			77196.34	111584.64	1692.87	109891.77	1.52
Minor Irrigation	122.08	4547.64			8246.84	12794.48	122.08	12672.40	0.95
Command Area Dev Prog.		2488.22			40.71	2528.93		2528.93	
Total B	***1814.96***	***41424.17***	***0.00***	***0.00***	**85483.89**	***126908.05***	***1814.96***	***125093.10***	***1.43***
Total	2116.63	56321.03			87445.24	143766.27	2116.63	141649.64	1.47
KARNATAKA				1996-97					
Parameters :					*12.21*				
Sewerage & Sanitation		3273.31			241.39	3514.70		3514.70	
Soil and Water Conservation		5706.90			756.36	6463.26		6463.26	
Fisheries	462.49	1879.63			528.55	2408.18	462.49	1945.69	19.20
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		3771.64				3771.64		3771.64	
Environ. Forestry and Wildlife	40.06	1337.94			0.23	1338.17	40.06	1298.11	2.99
Agri. Research and Education									
Special Areas Dev Prog.		1646.03				1646.03		1646.03	
Flood Control and Drainage		32.66			786.45	819.11		819.11	
Non-Conv. Sources of Energy	0.15	1509.01				1509.01	0.15	1508.87	0.01
Total A	***502.70***	***19157.11***	***0.00***	***0.00***	**2312.98**	***21470.09***	***502.70***	***20967.39***	***2.34***
Major and Medium Irrigation	1710.24	41968.60			90167.44	132136.04	1710.24	130425.80	1.29
Minor Irrigation	156.21	5530.80			9248.90	14779.70	156.21	14623.49	1.06
Command Area Dev Prog.		3193.22			41.65	3234.87		3234.87	
Total B	***1866.45***	***50692.62***	***0.00***	***0.00***	99457.99	***150150.61***	***1866.45***	***148284.16***	***1.24***
Total	2369.15	69849.73			101770.97	171620.70	2369.15	169251.56	1.38

Basic Source: *Finance Accounts*

*including imputed interest on investment

Notes as in Table A1.

Appendix 3.13: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Kerala

Units in Rs lakh and Recvy. rate in %

KERALA				1994-95	effec. int. rate				
Parameters :					***11.39***				
Description	**Rev Rec.**	**Rev Exp.**	**Div.**	**Int.on loans**	**Annualised Cost of Cap.***	**Total Costs**	**Total Rec.**	**Subsidy**	**Recvy. rate**
Sewerage & Sanitation	0.45	1514.47			247.11	1761.58	0.45	1761.13	0.03
Soil and Water Conservation		1106.95			193.12	1300.07		1300.07	
Fisheries	121.47	2676.76			1539.36	4216.12	121.47	4094.65	2.88
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		1008.68			2.66	1011.34		1011.34	
Environ. Forestry and Wildlife		769.04			5.72	774.76		774.76	
Agri. Research and Education									
Special Areas Dev Prog.									
Flood Control and Drainage		1878.11			2793.98	4672.09		4672.09	
Non-Conv. Sources of Energy		579.52				579.52		579.52	
Total A	***121.92***	***9533.53***	***0.00***	***0.00***	**4781.95**	***14315.47***	***121.92***	***14193.56***	***0.85***
Major and Medium Irrigation	179.36	3305.38			17751.59	21056.97	179.36	20877.61	0.85
Minor Irrigation	56.24	3071.46			1522.65	4594.10	56.24	4537.86	1.22
Command Area Dev Prog.		2107.51				2107.51		2107.51	
Total B	***235.60***	***8484.35***	***0.00***	***0.00***	19274.24	***27758.59***	***235.60***	***27522.99***	***0.85***
Total	**357.51**	**18017.87**			**24056.19**	**42074.06**	**357.51**	**41716.55**	**0.85**
KERALA				1995-96					
Parameters :					***10.70***				
Sewerage & Sanitation	0.45	1373.61			245.91	1619.52	0.45	1619.07	0.03
Soil and Water Conservation		1303.91			187.94	1491.85		1491.85	
Fisheries	108.37	3418.56			1838.83	5257.40	108.37	5149.03	2.06
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		1433.91			2.56	1436.47		1436.47	
Environ. Forestry and Wildlife		753.21			13.56	766.77		766.77	
Agri. Research and Education									
Special Areas Dev Prog.		70.00				70.00		70.00	
Flood Control and Drainage		1494.02			2859.51	4353.53		4353.53	
Non-Conv. Sources of Energy		716.80				716.80		716.80	
Total A	***108.82***	***10564.02***	***0.00***	***0.00***	**5148.31**	***15712.33***	***108.82***	***15603.51***	***0.69***
Major and Medium Irrigation	266.30	3470.11			18791.35	22261.46	266.30	21995.15	1.20
Minor Irrigation	46.30	5153.80			1703.36	6857.16	46.30	6810.86	0.68
Command Area Dev Prog.		2077.34				2077.34		2077.34	
Total B	***312.60***	***10701.25***	***0.00***	***0.00***	**20494.71**	***31195.96***	***312.60***	***30883.36***	***1.00***
Total	**421.42**	**21265.27**			**25643.02**	**46908.29**	**421.42**	**46486.87**	**0.90**
KERALA				1996-97					
Parameters :					***11.14***				
Sewerage & Sanitation	0.14	2620.92			275.11	2896.03	0.14	2895.89	0.00
Soil and Water Conservation		1694.62			196.84	1891.46		1891.46	
Fisheries	97.96	3152.39			2471.52	5623.91	97.96	5525.95	1.74
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		1373.39			2.63	1376.02		1376.02	
Environ. Forestry and Wildlife		858.51			17.23	875.74		875.74	
Agri. Research and Education									
Special Areas Dev Prog.		39.52				39.52		39.52	
Flood Control and Drainage		2549.41			3244.34	5793.74		5793.74	
Non-Conv. Sources of Energy		1458.08			3.11	1461.19		1461.19	
Total A	***98.10***	***13746.83***	***0.00***	***0.00***	**6210.78**	***19957.61***	***98.10***	***19859.51***	***0.49***
Major and Medium Irrigation	219.70	3501.62			21607.31	25108.93	219.70	24889.23	0.87
Minor Irrigation	100.15	4462.56			1936.45	6399.01	100.15	6298.86	1.57
Command Area Dev Prog.		1058.65				1058.65		1058.65	
Total B	***319.85***	***9022.82***	***0.00***	***0.00***	**23543.76**	***32566.58***	***319.85***	***32246.73***	***0.98***
Total	417.95	22769.66			**29754.54**	**52524.20**	**417.95**	**52106.24**	**0.80**

Basic Source: *Finance Accounts*
*including imputed interest on investment
Notes as in Table A1.

MADHYA PRADESH				1994-95	effec. int. rate				
Parameters :					***10.14***				
Description	**Rev Rec.**	**Rev Exp.**	**Div.**	**Int.on loans**	**Annualised Cost of Cap.***	**Total Costs**	**Total Rec.**	**Subsidy**	**Recvy. rate**
Sewerage & Sanitation	89.21	1154.29			36.78	1191.07	89.21	1101.85	7.49
Soil and Water Conservation		3143.06			1372.74	4515.80		4515.80	
Fisheries	192.82	1187.02			23.14	1210.16	192.82	1017.34	15.93
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		20813.45			14.08	20827.53		20827.53	
Environ. Forestry and Wildlife		902.51				902.51		902.51	
Agri. Research and Education		121.25				121.25		121.25	
Special Areas Dev Prog.		1090.56				1090.56		1090.56	
Flood Control and Drainage					236.67	236.67		236.67	
Non-Conv. Sources of Energy		106.45				106.45		106.45	
Total A	***282.03***	***28518.58***	***0.00***	***0.00***	1683.41	***30202.00***	***282.03***	***29919.96***	***0.93***
Major and Medium Irrigation	4019.43	13717.33			57064.80	70782.13	4019.43	66762.70	5.68
Minor Irrigation	886.87	4726.40			22155.36	26881.77	886.87	25994.90	3.30
Command Area Dev Prog.		2897.07			1216.42	4113.49		4113.49	
Total B	***4906.30***	***21340.81***	***0.00***	***0.00***	**80436.58**	***101777.38***	***4906.30***	***96871.09***	***4.82***
Total	**5188.33**	**49859.39**			82119.99	131979.38	**5188.33**	**126791.05**	**3.93**
MADHYA PRADESH				1995-96					
Parameters :					***10.37***				
Sewerage & Sanitation	203.27	1692.25			37.35	1729.61	203.27	1526.34	11.75
Soil and Water Conservation		3213.82			1562.00	4775.81		4775.81	
Fisheries	105.03	1304.71			26.28	1330.99	105.03	1225.95	7.89
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		23074.10			14.28	23088.38		23088.38	
Environ. Forestry and Wildlife		1002.70				1002.70		1002.70	
Agri. Research and Education		129.43				129.43		129.43	
Special Areas Dev Prog.		1455.79				1455.79		1455.79	
Flood Control and Drainage					243.23	243.23		243.23	
Non-Conv. Sources of Energy		0.26				0.26		0.26	
Total A	***308.30***	***31873.06***	***0.00***	***0.00***	1883.14	***33756.20***	***308.30***	***33447.90***	***0.91***
Major and Medium Irrigation	3648.56	17114.82			63332.61	80447.43	3648.56	76798.87	4.54
Minor Irrigation	774.38	4127.38			23576.90	27704.28	774.38	26929.90	2.80
Command Area Dev Prog.		4436.76			1310.62	5747.38		5747.38	
Total B	***4422.94***	***25678.96***	***0.00***	***0.00***	**88220.13**	***113899.09***	***4422.94***	***109476.15***	***3.88***
Total	**4731.25**	**57552.02**			**90103.27**	**147655.29**	**4731.25**	**142924.04**	**3.20**
MADHYA PRADESH				1996-97					
Parameters :					***10.59***				
Sewerage & Sanitation	283.86	1949.96			37.98	1987.94	283.86	1704.08	14.28
Soil and Water Conservation		4053.10			1701.35	5754.45		5754.45	
Fisheries	151.07	1824.39			27.66	1852.05	151.07	1700.98	8.16
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		29254.44			14.49	29268.93		29268.93	
Environ. Forestry and Wildlife		1329.84				1329.84		1329.84	
Agri. Research and Education		138.23				138.23		138.23	
Special Areas Dev Prog.		1535.08				1535.08		1535.08	
Flood Control and Drainage					249.90	249.90		249.90	
Non-Conv. Sources of Energy	0.14						0.14	-0.14	
Total A	***435.07***	***40085.04***	***0.00***	***0.00***	**2031.39**	***42116.43***	***435.07***	***41681.36***	***1.03***
Major and Medium Irrigation	4470.51	17960.91			68828.65	86789.56	4470.51	82319.05	5.15
Minor Irrigation	710.85	4267.95			25198.92	29466.88	710.85	28756.03	2.41
Command Area Dev Prog.		4272.24			1432.85	5705.09		5705.09	
Total B	***5181.35***	***26501.11***	***0.00***	***0.00***	95460.42	***121961.53***	***5181.35***	***116780.18***	***4.25***
Total	5616.42	66586.15			97491.81	164077.96	5616.42	158461.54	3.42

Basic Source: *Finance Accounts*

*including imputed interest on investment

Notes as in Table A1.

Appendix 3.15: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Maharashtra

Units in Rs lakh and Recvy. rate in %

Description	Rev Rec.	Rev Exp.	Div.	Int.on loans	Annualised Cost of Cap.*	Total Costs	Total Rec.	Subsidy	Recvy. rate
MAHARASHTRA				1994-95	effec. int. rate				
Parameters :					*12.36*				
Sewerage & Sanitation	82.48	70.50			32.21	102.71	82.48	20.22	80.31
Soil and Water Conservation		6182.11		0.11	7445.57	13627.68	0.11	13627.57	0.00
Fisheries	150.20	1431.03		2.94	997.46	2428.49	153.14	2275.35	6.31
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		13349.08			780.34	14129.42		14129.42	
Environ. Forestry and Wildlife	72.11	596.71			20.07	616.78	72.11	544.67	11.69
Agri. Research and Education		241.19			105.53	346.72		346.72	
Special Areas Dev Prog.		1942.46				1942.46		1942.46	
Flood Control and Drainage		7.58			286.36	293.94		293.94	
Non-Conv. Sources of Energy	25.16	1047.77				1047.77	25.16	1022.61	2.40
Total A	***329.95***	***24868.43***	***0.00***	***3.05***	9667.54	***34535.96***	***333.00***	***34202.96***	***0.96***
Major and Medium Irrigation	7098.54	88329.28			109210.26	197539.55	7098.54	190441.01	3.59
Minor Irrigation	1701.17	20206.19			17451.82	37658.01	1701.17	35956.84	4.52
Command Area Dev Prog.		2819.33		0.03	55.50	2874.84	0.03	2874.81	0.00
Total B	***8799.71***	***111354.81***	***0.00***	***0.03***	126717.58	***238072.39***	***8799.74***	***229272.65***	***3.70***
Total	**9129.66**	**136223.24**		**3.08**	**136385.12**	**272608.36**	**9132.74**	**263475.62**	**3.35**
MAHARASHTRA				1995-96					
Parameters :					*12.70*				
Sewerage & Sanitation	6.65	286.93			32.83	319.76	6.65	313.12	2.08
Soil and Water Conservation		7120.95		0.13	10327.79	17448.74	0.13	17448.61	0.00
Fisheries	206.69	1555.16		2.42	1147.11	2702.27	209.10	2493.16	7.74
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		14354.01			893.46	15247.47		15247.47	
Environ. Forestry and Wildlife	143.38	750.53			20.45	770.98	143.38	627.60	18.60
Agri. Research and Education		261.92			115.61	377.53		377.53	
Special Areas Dev Prog.		1224.29				1224.29		1224.29	
Flood Control and Drainage		7.55			304.16	311.71		311.71	
Non-Conv. Sources of Energy	54.49	897.63				897.63	54.49	843.14	6.07
Total A	***411.20***	***26458.97***	***0.00***	***2.54***	12841.41	***39300.38***	***413.74***	***38886.64***	***1.05***
Major and Medium Irrigation	7701.74	106192.92			129588.72	235781.64	7701.74	228079.89	3.27
Minor Irrigation	1459.31	23768.26			22044.83	45813.09	1459.31	44353.78	3.19
Command Area Dev Prog.		3501.76			56.69	3558.46		3558.46	
Total B	***9161.05***	***133462.94***	***0.00***	***0.00***	151690.24	***285153.18***	***9161.05***	***275992.13***	***3.21***
Total	**9572.25**	**159921.91**		**2.54**	**164531.65**	**324453.56**	**9574.79**	**314878.77**	**2.95**
MAHARASHTRA				1996-97					
Parameters :					*13.39*				
Sewerage & Sanitation	90.35	5533.27			34.08	5567.35	90.35	5477.00	1.62
Soil and Water Conservation		9485.34		0.05	13754.22	23239.56	0.05	23239.51	0.00
Fisheries	245.42	1748.52		0.81	1378.84	3127.35	246.23	2881.12	7.87
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		18032.40			1044.03	19076.43		19076.43	
Environ. Forestry and Wildlife	126.34	733.65			21.24	754.89	126.34	628.55	16.74
Agri. Research and Education		273.30			130.09	403.39		403.39	
Special Areas Dev Prog.		2342.51				2342.51		2342.51	
Flood Control and Drainage		14.34			339.05	353.39		353.39	
Non-Conv. Sources of Energy	26.36	741.37				741.37	26.36	715.01	3.56
Total A	***488.47***	***38904.69***	***0.00***	***0.87***	16701.55	***55606.24***	***489.34***	***55116.90***	***0.88***
Major and Medium Irrigation	5799.66	124208.65			157979.98	282188.64	5799.66	276388.98	2.06
Minor Irrigation	951.90	24367.36			28557.96	52925.32	951.90	51973.41	1.80
Command Area Dev Prog.		2862.97		0.15	59.75	2922.72	0.15	2922.57	0.01
Total B	***6751.56***	***151438.98***	***0.00***	***0.15***	186597.69	***338036.67***	***6751.71***	***331284.96***	***2.00***
Total	**7240.03**	**190343.67**		**1.02**	**203299.24**	393642.91	**7241.05**	**386401.86**	1.84

Basic Source: *Finance Accounts*

*including imputed interest on investment

Notes as in Table A1.

Appendix 3.16: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Manipur

Units in Rs lakh and Recvy. rate in %

Description	Rev Rec.	Rev Exp.	Div.	Int.on loans	Annualised Cost of Cap.*	Total Costs	Total Rec.	Subsidy	Recvy. rate
MANIPUR				1994-95	effec. int. rate				
Parameters :					***10.51***				
Sewerage & Sanitation	35.71	20.75			129.32	150.07	35.71	114.36	23.80
Soil and Water Conservation		396.95			288.18	685.13		685.13	
Fisheries	5.63	395.07			37.86	432.93	5.63	427.30	1.30
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		8.66				8.66		8.66	
Environ. Forestry and Wildlife		101.64			1.17	102.81		102.81	
Agri. Research and Education									
Special Areas Dev Prog.									
Flood Control and Drainage		426.95			413.69	840.64		840.64	
Non-Conv. Sources of Energy	1.60	42.83				42.83	1.60	41.23	3.73
Total A	***42.94***	***1392.84***	***0.00***	***0.00***	**870.22**	***2263.06***	***42.94***	***2220.12***	***1.90***
Major and Medium Irrigation	88.92	409.65			3794.43	4204.07	88.92	4115.16	2.12
Minor Irrigation	2.04	95.05			325.97	421.02	2.04	418.98	0.49
Command Area Dev Prog.		225.73			2.14	227.88		227.88	
Total B	***90.96***	***730.43***	***0.00***	***0.00***	**4122.55**	***4852.97***	***90.96***	***4762.01***	***1.87***
Total	**133.90**	**2123.27**			4992.77	7116.04	**133.90**	**6982.14**	**1.88**
MANIPUR				1995-96					
Parameters :					***15.89***				
Sewerage & Sanitation	9.22	21.67			218.69	240.36	9.22	231.14	3.83
Soil and Water Conservation		933.83			386.74	1320.57		1320.57	
Fisheries	6.75	512.54			52.96	565.49	6.75	558.74	1.19
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		6.07				6.07		6.07	
Environ. Forestry and Wildlife		93.68			1.57	95.25		95.25	
Agri. Research and Education		6.82				6.82		6.82	
Special Areas Dev Prog.		16.40				16.40		16.40	
Flood Control and Drainage		525.45			645.77	1171.22		1171.22	
Non-Conv. Sources of Energy	5.38	52.95				52.95	5.38	47.58	10.16
Total A	***21.35***	***2169.41***	***0.00***	***0.00***	**1305.72**	***3475.13***	***21.35***	***3453.79***	***0.61***
Major and Medium Irrigation	31.28	433.01			5679.16	6112.17	31.28	6080.89	0.51
Minor Irrigation	1.22	82.31			537.26	619.57	1.22	618.35	0.20
Command Area Dev Prog.		252.04			2.88	254.92		254.92	
Total B	***32.50***	***767.35***	***0.00***	***0.00***	**6219.30**	***6986.66***	***32.50***	***6954.15***	***0.47***
Total	**53.85**	**2936.76**			**7525.03**	**10461.79**	**53.85**	**10407.94**	**0.51**
MANIPUR				1996-97					
Parameters :					***11.22***				
Sewerage & Sanitation	23.38	504.07			65.77	569.84	23.38	546.46	4.10
Soil and Water Conservation	0.34	1007.94			301.21	1309.15	0.34	1308.81	0.03
Fisheries	4.36	561.99			45.30	607.29	4.36	602.93	0.72
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		10.75				10.75		10.75	
Environ. Forestry and Wildlife		339.58			1.22	340.80		340.80	
Agri. Research and Education		16.90				16.90		16.90	
Special Areas Dev Prog.									
Flood Control and Drainage		657.15			573.02	1230.17		1230.17	
Non-Conv. Sources of Energy	9.23	59.46				59.46	9.23	50.23	15.53
Total A	***37.31***	***3157.84***	***0.00***	***0.00***	**986.52**	***4144.36***	***37.31***	***4107.05***	***0.90***
Major and Medium Irrigation	57.30	458.81			4935.98	5394.79	57.30	5337.49	1.06
Minor Irrigation	0.45	188.41			510.15	698.56	0.45	698.11	0.06
Command Area Dev Prog.		307.80			2.24	310.04		310.04	
Total B	***57.75***	***955.02***	***0.00***	***0.00***	**5448.38**	***6403.40***	***57.75***	***6345.65***	***0.90***
Total	**95.07**	4112.86			**6434.90**	**10547.76**	**95.07**	**10452.69**	**0.90**

Basic Source: *Finance Accounts*

*including imputed interest on investment

Notes as in Table A1.

Appendix 3.17: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Meghalaya

Units in Rs lakh and Recvy. rate in %

Description	Rev Rec.	Rev Exp.	Div.	Int.on loans	Annualised Cost of Cap.*	Total Costs	Total Rec.	Subsidy	Recvy. rate
MEGHALAYA				1994-95	effec. int. rate				
Parameters :					***13.83***				
Sewerage & Sanitation		18.25			107.74	125.99		125.99	
Soil and Water Conservation		1254.20				1254.20		1254.20	
Fisheries	2.69	181.73			6.79	188.52	2.69	185.83	1.43
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		97.92			25.04	122.96		122.96	
Environ. Forestry and Wildlife		321.37				321.37		321.37	
Agri. Research and Education		47.76				47.76		47.76	
Special Areas Dev Prog.									
Flood Control and Drainage		25.89			120.42	146.30		146.30	
Non-Conv. Sources of Energy	0.27	35.00				35.00	0.27	34.73	0.77
Total A	***2.96***	***1982.11***	*0.00*	*0.00*	**259.98**	***2242.09***	***2.96***	***2239.13***	***0.13***
Major and Medium Irrigation	0.10	12.82			67.85	80.67	0.10	80.57	0.13
Minor Irrigation	3.23	367.47			315.48	682.95	3.23	679.72	0.47
Command Area Dev Prog.									
Total B	***3.34***	***380.29***	*0.00*	*0.00*	**383.34**	***763.62***	***3.34***	***760.28***	***0.44***
Total	**6.30**	**2362.39**			**643.32**	**3005.71**	**6.30**	**2999.41**	**0.21**
MEGHALAYA				1995-96					
Parameters :					***12.47***				
Sewerage & Sanitation		15.00			100.05	115.05		115.05	
Soil and Water Conservation		1631.77				1631.77		1631.77	
Fisheries	3.29	212.07			6.83	218.90	3.29	215.60	1.50
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		111.16			23.25	134.41		134.41	
Environ. Forestry and Wildlife		392.51				392.51		392.51	
Agri. Research and Education		50.05				50.05		50.05	
Special Areas Dev Prog.									
Flood Control and Drainage		27.12			144.18	171.30		171.30	
Non-Conv. Sources of Energy	0.08	24.70				24.70	0.08	24.62	0.33
Total A	***3.37***	***2464.37***	*0.00*	*0.00*	**274.30**	***2738.68***	***3.37***	***2735.31***	***0.12***
Major and Medium Irrigation	0.20	14.28			71.16	85.44	0.20	85.23	0.24
Minor Irrigation	2.49	453.78			333.80	787.58	2.49	785.09	0.32
Command Area Dev Prog.									
Total B	***2.69***	***468.05***	*0.00*	*0.00*	**404.96**	***873.01***	***2.69***	***870.32***	***0.31***
Total	**6.06**	**2932.43**			**679.26**	**3611.69**	**6.06**	**3605.63**	**0.17**
MEGHALAYA				1996-97					
Parameters :					***12.78***				
Sewerage & Sanitation		15.00			101.82	116.82		116.82	
Soil and Water Conservation		1535.53				1535.53		1535.53	
Fisheries	3.89	295.33			8.75	304.08	3.89	300.19	1.28
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		128.60			23.66	152.26		152.26	
Environ. Forestry and Wildlife		273.21				273.21		273.21	
Agri. Research and Education		60.84				60.84		60.84	
Special Areas Dev Prog.									
Flood Control and Drainage		31.02			261.24	292.26		292.26	
Non-Conv. Sources of Energy	0.03	44.35				44.35	0.03	44.32	0.06
Total A	***3.92***	***2383.88***	*0.00*	*0.00*	395.47	***2779.35***	***3.92***	***2775.43***	***0.14***
Major and Medium Irrigation	0.13	11.96			103.54	115.50	0.13	115.37	0.12
Minor Irrigation	4.22	538.64			409.79	948.44	4.22	944.22	0.44
Command Area Dev Prog.									
Total B	***4.35***	***550.61***	*0.00*	*0.00*	513.33	***1063.94***	***4.35***	***1059.59***	***0.41***
Total	8.27	2934.49			**908.80**	3843.29	8.27	3835.02	0.22

Basic Source: *Finance Accounts*

*including imputed interest on investment

Notes as in Table A1.

Appendix 3.18: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Mizoram

Units in Rs lakh and Recvy. rate in %

Description	Rev Rec.	Rev Exp.	Div.	Int.on loans	Annualised Cost of Cap.*	Total Costs	Total Rec.	Subsidy	Recvy. rate
MIZORAM				1994-95	effec. int. rate				
Parameters :					**8.77**				
Sewerage and Sanitation		19.07			4.15	23.22		23.22	
Soil and Water Conservation		553.05				553.05		553.05	
Fisheries	2.81	102.66			1.73	104.39	2.81	101.58	2.69
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		731.15			0.39	731.54		731.54	
Environ. Forestry and Wildlife									
Agri Research and Education									
Special Areas Development Prog.									
Flood Control and Drainage									
Non-Conventional Sources of Energy									
Total A	***2.81***	***1405.93***	***0.00***	***0.00***	6.27	***1412.19***	***2.81***	***1409.38***	***0.20***
Major and Medium Irrigation		4.25			13.46	17.71		17.71	
Minor Irrigation	5.84	267.83			33.18	301.01	5.84	295.17	1.94
Command Areas Development Prog.		4.08				4.08		4.08	
Total B	***5.84***	***276.16***	***0.00***	***0.00***	46.64	***322.81***	***5.84***	***316.97***	***1.81***
Total	**8.65**	**1682.09**			**52.91**	**1735.00**	**8.65**	**1726.35**	**0.50**
MIZORAM				1995-96					
Parameters :					**8.93**				
Sewerage and Sanitation		28.72			4.20	32.91		32.91	
Soil and Water Conservation		522.74				522.74		522.74	
Fisheries	2.57	175.95			3.10	179.05	2.57	176.48	1.44
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		700.24			0.39	700.63		700.63	
Environ. Forestry and Wildlife		90.08				90.08		90.08	
Agri Research and Education									
Special Areas Development Prog.									
Flood Control and Drainage									
Non-Conventional Sources of Ener	0.03				-1.53	-1.53	0.03	-1.56	-2.02
Total A	***2.60***	***1517.73***	***0.00***	***0.00***	6.16	***1523.89***	***2.60***	***1521.29***	***0.17***
Major and Medium Irrigation		2.00			13.62	15.62		15.62	
Minor Irrigation	2.18	254.97			34.14	289.11	2.18	286.93	0.75
Command Areas Development Prog.		4.99				4.99		4.99	
Total B	***2.18***	***261.96***	***0.00***	***0.00***	47.76	***309.72***	***2.18***	***307.54***	***0.70***
Total	**4.78**	1779.69			**53.92**	**1833.61**	**4.78**	**1828.83**	**0.26**
MIZORAM				1996-97					
Parameters :					**9.99**				
Sewerage and Sanitation		22.51			4.51	27.02		27.02	
Soil and Water Conservation		612.48				612.48		612.48	
Fisheries	6.01	146.31			5.62	151.93	6.01	145.92	3.95
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		601.27			0.42	601.69		601.69	
Environ. Forestry and Wildlife		94.43				94.43		94.43	
Agri Research and Education									
Special Areas Development Prog.									
Flood Control and Drainage									
Non-Conventional Sources of Energy		0.40			4.05	4.45		4.45	
Total A	***6.01***	***1477.40***	***0.00***	***0.00***	14.61	***1492.01***	***6.01***	***1486.00***	***0.40***
Major and Medium Irrigation					14.64	14.64		14.64	
Minor Irrigation	0.26	227.98			36.70	264.68	0.26	264.42	0.10
Command Areas Development Prog.		5.00				5.00		5.00	
Total B	***0.26***	***232.98***	***0.00***	***0.00***	51.34	***284.32***	***0.26***	***284.06***	***0.09***
Total	6.27	1710.38			65.94	1776.33	6.27	1770.06	**0.35**

Basic Source: *Finance Accounts*
*including imputed interest on investment
Notes as in Table A1.

Appendix 3.19: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Nagaland

Units in Rs lakh and Recvy. rate in %

NAGALAND				1994-95	effec. int. rate				
Parameters :					***12.00***				
Description	**Rev Rec.**	**Rev Exp.**	**Div.**	**Int.on loans**	**Annualised Cost of Cap.***	**Total Costs**	**Total Rec.**	**Subsidy**	**Recvy. rate**
Sewerage & Sanitation					288.25	288.25		288.25	
Soil and Water Conservation		642.68				642.68		642.68	
Fisheries	0.61	155.75			2.97	158.72	0.61	158.12	0.38
Forestry and Wildlife									
Forest Cons., Dev., and Regen.									
Environ. Forestry and Wildlife		27.82				27.82		27.82	
Agri. Research and Education		11.16				11.16		11.16	
Special Areas Dev Prog.									
Flood Control and Drainage									
Non-Conv. Sources of Energy		6.72				6.72		6.72	
Total A	***0.61***	***844.14***	***0.00***	***0.00***	**291.22**	***1135.36***	***0.61***	***1134.75***	***0.05***
Major and Medium Irrigation									
Minor Irrigation	1.40	514.21			32.33	546.53	1.40	545.13	0.26
Command Area Dev Prog.									
Total B	***1.40***	***514.21***	***0.00***	***0.00***	**32.33**	***546.53***	***1.40***	***545.13***	***0.26***
Total	**2.01**	**1358.35**			**323.55**	**1681.89**	**2.01**	**1679.88**	**0.12**
NAGALAND				1995-96					
Parameters :					***12.91***				
Sewerage & Sanitation					303.33	303.33		303.33	
Soil and Water Conservation		964.48				964.48		964.48	
Fisheries	0.31	281.97			6.22	288.19	0.31	287.87	0.11
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		1.00				1.00		1.00	
Environ. Forestry and Wildlife	6.70	162.68				162.68	6.70	155.98	4.12
Agri. Research and Education		20.19				20.19		20.19	
Special Areas Dev Prog.									
Flood Control and Drainage									
Non-Conv. Sources of Energy		7.00				7.00		7.00	
Total A	***7.01***	***1437.32***	***0.00***	***0.00***	**309.55**	***1746.87***	***7.01***	***1739.86***	***0.40***
Major and Medium Irrigation									
Minor Irrigation	1.39	665.12			34.02	699.13	1.39	697.75	0.20
Command Area Dev Prog.									
Total B	***1.39***	***665.12***	***0.00***	***0.00***	**34.02**	***699.13***	***1.39***	***697.75***	***0.20***
Total	**8.40**	**2102.44**			**343.56**	**2446.00**	**8.40**	**2437.60**	**0.34**
NAGALAND				1996-97					
Parameters :					***11.01***				
Sewerage & Sanitation					271.75	271.75		271.75	
Soil and Water Conservation		1427.86			1.07	1428.92		1428.92	
Fisheries	1.20	319.81			22.46	342.27	1.20	341.07	0.35
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		6.47				6.47		6.47	
Environ. Forestry and Wildlife	48.03	64.12				64.12	48.03	16.09	74.91
Agri. Research and Education		94.31				94.31		94.31	
Special Areas Dev Prog.									
Flood Control and Drainage									
Non-Conv. Sources of Energy		21.40				21.40		21.40	
Total A	***49.23***	***1933.97***	***0.00***	***0.00***	**295.29**	***2229.25***	***49.23***	***2180.02***	***2.21***
Major and Medium Irrigation									
Minor Irrigation	1.02	817.18			30.46	847.64	1.02	846.62	0.12
Command Area Dev Prog.									
Total B	***1.02***	***817.18***	***0.00***	***0.00***	**30.46**	***847.64***	***1.02***	***846.62***	***0.12***
Total	50.26	2751.15			325.74	3076.89	50.26	3026.63	1.63

Basic Source: *Finance Accounts*
*including imputed interest on investment
Notes as in Table A1.

Appendix 3.20: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Orissa

Units in Rs lakh and Recvy. rate in %

ORISSA				1994-95	effec. int. rate				
Parameters :					*11.22*				
Description	**Rev Rec.**	**Rev Exp.**	**Div.**	**Int.on loans**	**Annualised Cost of Cap.***	**Total Costs**	**Total Rec.**	**Subsidy**	**Recvy. rate**
Sewerage & Sanitation		138.54			135.30	273.84		273.84	
Soil and Water Conservation		3165.21			48.49	3213.70		3213.70	
Fisheries	178.29	1232.32			595.47	1827.79	178.29	1649.50	9.75
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		155.02			0.10	155.12		155.12	
Environ. Forestry and Wildlife	43.65	345.06			4.32	349.38	43.65	305.73	12.49
Agri. Research and Education		66.54				66.54		66.54	
Special Areas Dev Prog.		1705.08				1705.08		1705.08	
Flood Control and Drainage		1409.08			2391.31	3800.39		3800.39	
Non-Conv. Sources of Energy		267.72			0.23	267.95		267.95	
Total A	***221.94***	***8484.57***	***0.00***	***0.00***	**3175.21**	***11659.77***	***221.94***	***11437.83***	***1.90***
Major and Medium Irrigation	492.93	4260.66			38388.46	42649.12	492.93	42156.19	1.16
Minor Irrigation	76.83	4742.36			5919.42	10661.77	76.83	10584.95	0.72
Command Area Dev Prog.		816.35			33.78	850.13		850.13	
Total B	***569.76***	***9819.37***	***0.00***	***0.00***	**44341.65**	***54161.02***	***569.76***	***53591.27***	***1.05***
Total	**791.70**	**18303.94**			**47516.86**	**65820.80**	**791.70**	**65029.10**	**1.20**
ORISSA				1995-96					
Parameters :					*11.67*				
Sewerage & Sanitation	88.23	382.46			157.92	540.38	88.23	452.15	16.33
Soil and Water Conservation		5185.44			51.10	5236.55		5236.55	
Fisheries	141.93	1419.57			677.19	2096.76	141.93	1954.82	6.77
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		357.93			0.10	358.03		358.03	
Environ. Forestry and Wildlife	37.23	364.74			4.44	369.18	37.23	331.95	10.08
Agri. Research and Education		75.95				75.95		75.95	
Special Areas Dev Prog.		390.74				390.74		390.74	
Flood Control and Drainage		1589.03			2578.63	4167.66		4167.66	
Non-Conv. Sources of Energy		169.91			0.24	170.15		170.15	
Total A	***267.40***	***9935.77***	***0.00***	***0.00***	**3469.62**	***13405.39***	***267.40***	***13137.99***	***1.99***
Major and Medium Irrigation	1118.64	4523.97			42029.83	46553.80	1118.64	45435.16	2.40
Minor Irrigation	191.83	6178.88			6500.35	12679.22	191.83	12487.39	1.51
Command Area Dev Prog.		834.13			35.16	869.29		869.29	
Total B	***1310.47***	***11536.97***	***0.00***	***0.00***	**48565.33**	***60102.30***	***1310.47***	***58791.83***	***2.18***
Total	**1577.87**	**21472.74**			**52034.95**	**73507.69**	**1577.87**	**71929.82**	**2.15**
ORISSA				1996-97					
Parameters :					*11.50*				
Sewerage & Sanitation		969.53			198.37	1167.89		1167.89	
Soil and Water Conservation		4658.05			48.80	4706.85		4706.85	
Fisheries	113.86	1503.86			777.10	2280.96	113.86	2167.10	4.99
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		220.55			0.10	220.65		220.65	
Environ. Forestry and Wildlife	62.89	410.91			4.39	415.30	62.89	352.41	15.14
Agri. Research and Education		96.12				96.12		96.12	
Special Areas Dev Prog.		385.34				385.34		385.34	
Flood Control and Drainage		1779.54			2690.16	4469.70		4469.70	
Non-Conv. Sources of Energy		173.68			0.23	173.91		173.91	
Total A	***176.75***	***10197.58***	***0.00***	***0.00***	3719.15	***13916.73***	***176.75***	***13739.98***	***1.27***
Major and Medium Irrigation	654.14	5101.97			44970.50	50072.46	654.14	49418.32	1.31
Minor Irrigation	200.79	10321.18			6915.13	17236.31	200.79	17035.52	1.16
Command Area Dev Prog.		780.85			34.62	815.47		815.47	
Total B	***854.93***	***16203.99***	***0.00***	***0.00***	51920.25	***68124.24***	***854.93***	***67269.31***	***1.25***
Total	**1031.69**	**26401.57**			**55639.40**	**82040.97**	**1031.69**	**81009.29**	**1.26**

Basic Source: *Finance Accounts*

*including imputed interest on investment

Notes as in Table A1.

Appendix 3.21: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Punjab

Units in Rs lakh and Recvy. rate in %

PUNJAB				1994-95	effec. int. rate				
Parameters :					***11.84***				
Description	**Rev Rec.**	**Rev Exp.**	**Div.**	**Int.on loans**	**Annualised Cost of Cap.***	**Total Costs**	**Total Rec.**	**Subsidy**	**Recvy. rate**
Sewerage & Sanitation		52.62			13.05	65.67		65.67	
Soil and Water Conservation		1490.94		116.25	3335.09	4826.03	116.25	4709.78	2.41
Fisheries	114.79	282.25			91.54	373.79	114.79	259.00	30.71
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		144.75				144.75		144.75	
Environ. Forestry and Wildlife		304.80			1.85	306.65		306.65	
Agri. Research and Education		8.69				8.69		8.69	
Special Areas Dev Prog.									
Flood Control and Drainage		437.71			1513.17	1950.88		1950.88	
Non-Conv. Sources of Energy		85.55			9.07	94.62		94.62	
Total A	***114.79***	***2807.31***	***0.00***	***116.25***	***4963.77***	***7771.08***	***231.04***	***7540.05***	***2.97***
Major and Medium Irrigation	3145.64	12056.58			26916.71	38973.29	3145.64	35827.65	8.07
Minor Irrigation	25.42	2639.34			1405.27	4044.61	25.42	4019.19	0.63
Command Area Dev Prog.					1056.35	1056.35		1056.35	
Total B	***3171.07***	***14695.92***	***0.00***	***0.00***	***29378.33***	***44074.25***	***3171.07***	***40903.18***	***7.19***
Total	**3285.86**	**17503.23**		**116.25**	**34342.10**	**51845.33**	**3402.10**	**48443.23**	**6.56**
PUNJAB				1995-96					
Parameters :					***12.25***				
Sewerage & Sanitation		376.18			13.04	389.22		389.22	
Soil and Water Conservation		1993.20		92.42	3439.71	5432.90	92.42	5340.48	1.70
Fisheries	75.47	263.50			94.47	357.97	75.47	282.50	21.08
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		145.24				145.24		145.24	
Environ. Forestry and Wildlife		340.09			1.90	341.99		341.99	
Agri. Research and Education		11.94				11.94		11.94	
Special Areas Dev Prog.									
Flood Control and Drainage		756.65			1568.82	2325.47		2325.47	
Non-Conv. Sources of Energy		101.20			9.29	110.49		110.49	
Total A	***75.47***	***3988.00***	***0.00***	***92.42***	***5127.22***	***9115.22***	***167.89***	***8947.33***	***1.84***
Major and Medium Irrigation	3014.15	13542.42			33578.51	47120.94	3014.15	44106.79	6.40
Minor Irrigation	28.46	2260.21			1630.99	3891.20	28.46	3862.74	0.73
Command Area Dev Prog.					1514.05	1514.05		1514.05	
Total B	***3042.61***	***15802.63***	***0.00***	***0.00***	***36723.55***	***52526.18***	***3042.61***	***49483.58***	***5.79***
Total	**3118.08**	**19790.63**		**92.42**	**41850.77**	**61641.40**	**3210.50**	**58430.90**	**5.21**
PUNJAB				1996-97					
Parameters :					***11.98***				
Sewerage & Sanitation		825.18			12.79	837.97		837.97	
Soil and Water Conservation		2240.34		94.23	3352.20	5592.54	94.23	5498.31	1.68
Fisheries	129.20	295.26			93.39	388.65	129.20	259.46	33.24
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		171.78				171.78		171.78	
Environ. Forestry and Wildlife	12.08	365.45			1.87	367.32	12.08	355.24	3.29
Agri. Research and Education		10.15				10.15		10.15	
Special Areas Dev Prog.									
Flood Control and Drainage		939.32			1577.91	2517.23		2517.23	
Non-Conv. Sources of Energy		65.47			9.15	74.62		74.62	
Total A	***141.28***	***4912.95***	***0.00***	***94.23***	***5047.30***	***9960.25***	***235.50***	***9724.75***	***2.36***
Major and Medium Irrigation	2764.11	15432.34			40400.24	55832.58	2764.11	53068.47	4.95
Minor Irrigation	22.82	2442.92			1775.97	4218.89	22.82	4196.07	0.54
Command Area Dev Prog.				0.01	1887.80	1887.80	0.01	1887.79	0.00
Total B	***2786.93***	***17875.26***	***0.00***	***0.01***	***44064.02***	***61939.28***	***2786.94***	***59152.34***	***4.50***
Total	**2928.21**	**22788.22**		**94.24**	**49111.32**	**71899.53**	**3022.45**	**68877.09**	**4.20**

Basic Source: *Finance Accounts*

*including imputed interest on investment

Notes as in Table A1.

Appendix 3.22: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Rajasthan

Units in Rs lakh and Recvy. rate in %

RAJASTHAN				1994-95	effec. int. rate				
Parameters :					***11.64***				
Description	**Rev Rec.**	**Rev Exp.**	**Div.**	**Int.on loans**	**Annualised Cost of Cap.***	**Total Costs**	**Total Rec.**	**Subsidy**	**Recvy. rate**
Sewerage & Sanitation	904.57	3488.65			199.35	3688.00	904.57	2783.43	24.53
Soil and Water Conservation		6255.52			104.00	6359.52		6359.52	
Fisheries	324.10	525.12			75.67	600.79	324.10	276.69	53.95
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		1055.10				1055.10		1055.10	
Environ. Forestry and Wildlife	37.39	1220.75				1220.75	37.39	1183.36	3.06
Agri. Research and Education		18.13				18.13		18.13	
Special Areas Dev Prog.		7531.86				7531.86		7531.86	
Flood Control and Drainage					938.21	938.21		938.21	
Non-Conv. Sources of Energy		357.06				357.06		357.06	
Total A	***1266.06***	***20452.19***	***0.00***	***0.00***	**1317.23**	***21769.42***	***1266.06***	***20503.35***	***5.82***
Major and Medium Irrigation	2109.38	29718.54			39466.62	69185.16	2109.38	67075.78	3.05
Minor Irrigation	1711.82	5241.33			5606.70	10848.03	1711.82	9136.21	15.78
Command Area Dev Prog.		5308.90			6753.29	12062.19		12062.19	
Total B	***3821.20***	***40268.78***	***0.00***	***0.00***	**51826.61**	***92095.39***	***3821.20***	***88274.19***	***4.15***
Total	**5087.26**	**60720.97**			**53143.84**	**113864.81**	**5087.26**	**108777.54**	**4.47**
RAJASTHAN				1995-96					
Parameters :					***11.86***				
Sewerage & Sanitation	1104.57	4020.37			256.84	4277.20	1104.57	3172.64	25.82
Soil and Water Conservation		7895.82			108.74	8004.56		8004.56	
Fisheries	359.54	546.04			80.77	626.81	359.54	267.26	57.36
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		720.02				720.02		720.02	
Environ. Forestry and Wildlife	53.37	1445.16				1445.16	53.37	1391.79	3.69
Agri. Research and Education		21.73				21.73		21.73	
Special Areas Dev Prog.		494.87				494.87		494.87	
Flood Control and Drainage					1027.29	1027.29		1027.29	
Non-Conv. Sources of Energy		421.88				421.88		421.88	
Total A	***1517.48***	***15565.89***	***0.00***	***0.00***	**1473.63**	***17039.52***	***1517.48***	***15522.04***	***8.91***
Major and Medium Irrigation	2144.23	33557.11			45808.44	79365.55	2144.23	77221.32	2.70
Minor Irrigation	2321.01	5338.21			6155.92	11494.13	2321.01	9173.12	20.19
Command Area Dev Prog.		7664.70			7654.88	15319.58		15319.58	
Total B	***4465.24***	***46560.02***	***0.00***	***0.00***	**59619.24**	***106179.27***	***4465.24***	***101714.03***	***4.21***
Total	**5982.72**	**62125.91**			**61092.88**	123218.79	**5982.72**	117236.07	4.86
RAJASTHAN				1996-97					
Parameters :					***12.38***				
Sewerage & Sanitation	1011.75	2415.10			293.19	2708.29	1011.75	1696.53	37.36
Soil and Water Conservation		5542.84			283.79	5826.63		5826.63	
Fisheries	401.54	503.18			85.36	588.54	401.54	187.00	68.23
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		864.46			22.22	886.68		886.68	
Environ. Forestry and Wildlife	36.59	1423.67			6.08	1429.75	36.59	1393.16	2.56
Agri. Research and Education		39.56				39.56		39.56	
Special Areas Dev Prog.		168.70				168.70		168.70	
Flood Control and Drainage					1356.15	1356.15		1356.15	
Non-Conv. Sources of Energy		167.39				167.39		167.39	
Total A	***1449.88***	***11124.90***	***0.00***	***0.00***	**2046.78**	***13171.68***	***1449.88***	***11721.80***	***11.01***
Major and Medium Irrigation	2427.05	37140.95			53471.07	90612.02	2427.05	88184.97	2.68
Minor Irrigation	2131.78	5517.33			7140.26	12657.59	2131.78	10525.81	16.84
Command Area Dev Prog.		5053.27		29.40	9105.72	14158.99	29.40	14129.59	0.21
Total B	***4558.83***	***47711.55***	***0.00***	***29.40***	69717.05	***117428.60***	***4588.23***	***112840.38***	***3.91***
Total	**6008.71**	**58836.45**		29.40	**71763.83**	**130600.28**	**6038.11**	124562.17	4.62

Basic Source: *Finance Accounts*

*including imputed interest on investment

Notes as in Table A1.

Appendix 3.23: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Sikkim

Units in Rs lakh and Recvy. rate in %

Description	Rev Rec.	Rev Exp.	Div.	Int.on loans	Annualised Cost of Cap.*	Total Costs	Total Rec.	Subsidy	Recvy. rate
SIKKIM				1994-95	effec. int. rate				
Parameters :					*12.16*				
Sewerage & Sanitation	1.39	27.54			79.80	107.33	1.39	105.94	1.30
Soil and Water Conservation		361.13				361.13		361.13	
Fisheries	0.49	57.29			28.45	85.74	0.49	85.25	0.57
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		13.09			0.55	13.64		13.64	
Environ. Forestry and Wildlife		135.00				135.00		135.00	
Agri. Research and Education									
Special Areas Dev Prog.									
Flood Control and Drainage		16.67				16.67		16.67	
Non-Conv. Sources of Energy	3.62	35.51				35.51	3.62	31.89	10.20
Total A	***5.50***	***646.23***	***0.00***	***0.00***	108.79	***755.02***	***5.50***	***749.51***	***0.73***
Major and Medium Irrigation									
Minor Irrigation	0.19	267.57				267.57	0.19	267.38	0.07
Command Area Dev Prog.		3.55				3.55		3.55	
Total B	***0.19***	***271.12***	***0.00***	***0.00***		***271.12***	***0.19***	***270.93***	***0.07***
Total	**5.70**	917.35			108.79	**1026.14**	5.70	**1020.44**	**0.56**
SIKKIM				1995-96					
Parameters :					*11.90*				
Sewerage & Sanitation	4.13	77.10			84.50	161.60	4.13	157.47	2.55
Soil and Water Conservation		333.23				333.23		333.23	
Fisheries	0.65	68.39			30.10	98.49	0.65	97.85	0.66
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		12.54			0.53	13.07		13.07	
Environ. Forestry and Wildlife		182.80				182.80		182.80	
Agri. Research and Education									
Special Areas Dev Prog.									
Flood Control and Drainage		41.01				41.01		41.01	
Non-Conv. Sources of Energy	2.89	69.17				69.17	2.89	66.29	4.17
Total A	***7.66***	***784.25***	***0.00***	***0.00***	115.13	***899.38***	***7.66***	***891.72***	***0.85***
Major and Medium Irrigation									
Minor Irrigation	0.31	286.50				286.50	0.31	286.19	0.11
Command Area Dev Prog.		5.77				5.77		5.77	
Total B	***0.31***	***292.27***	***0.00***	***0.00***		***292.27***	***0.31***	***291.96***	***0.11***
Total	7.97	**1076.52**			115.13	1191.65	7.97	**1183.68**	**0.67**
SIKKIM				1996-97					
Parameters :					*11.92*				
Sewerage & Sanitation	2.64	89.45			90.71	180.15	2.64	177.51	1.46
Soil and Water Conservation		492.66				492.66		492.66	
Fisheries	0.61	65.64			33.41	99.04	0.61	98.43	0.62
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		13.81			0.54	14.35		14.35	
Environ. Forestry and Wildlife		158.58				158.58		158.58	
Agri. Research and Education									
Special Areas Dev Prog.									
Flood Control and Drainage		240.95				240.95		240.95	
Non-Conv. Sources of Energy	1.08	49.36				49.36	1.08	48.28	2.19
Total A	***4.33***	***1110.44***	***0.00***	***0.00***	124.65	***1235.08***	***4.33***	***1230.76***	***0.35***
Major and Medium Irrigation									
Minor Irrigation	0.79	310.65				310.65	0.79	309.86	0.25
Command Area Dev Prog.		5.91				5.91		5.91	
Total B	***0.79***	***316.56***	***0.00***	***0.00***		***316.56***	***0.79***	***315.77***	***0.25***
Total	**5.11**	**1427.00**			124.65	1551.65	**5.11**	**1546.53**	**0.33**

Basic Source: *Finance Accounts*
*including imputed interest on investment
Notes as in Table A1.

Appendix 3.24: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Tamilnadu

Units in Rs lakh and Recvy. rate in %

TAMILNADU				1994-95	effec. int. rate				
Parameters :					***14.61***				
Description	**Rev Rec.**	**Rev Exp.**	**Div.**	**Int. on loans**	**Annualised Cost of Cap.***	**Total Costs**	**Total Rec.**	**Subsidy**	**Recvy. rate**
Sewerage & Sanitation	0.11	1025.39			1857.25	2882.64	0.11	2882.52	0.00
Soil and Water Conservation		2487.67			951.50	3439.16		3439.16	
Fisheries	240.07	2722.52			663.90	3386.42	240.07	3146.34	7.09
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		123.23			394.91	518.14		518.14	
Environ. Forestry and Wildlife		232.65			189.39	422.04		422.04	
Agri. Research and Education		335.44			86.83	422.27		422.27	
Special Areas Dev Prog.		1094.19			32.07	1126.26		1126.26	
Flood Control and Drainage		179.20			523.97	703.17		703.17	
Non-Conv. Sources of Energy		417.36				417.36		417.36	
Total A	***240.19***	***8617.65***	***0.00***	***0.00***	4699.81	***13317.45***	***240.19***	***13077.27***	***1.80***
Major and Medium Irrigation	364.47	12625.30			17750.75	30376.05	364.47	30011.58	1.20
Minor Irrigation	258.09	5192.42			628.86	5821.28	258.09	5563.19	4.43
Command Area Dev Prog.		1360.71			724.01	2084.72		2084.72	
Total B	***622.57***	***19178.43***	***0.00***	***0.00***	19103.63	***38282.06***	***622.57***	***37659.49***	***1.63***
Total	862.75	27796.08			23803.43	51599.51	862.75	50736.76	1.67
TAMILNADU				1995-96					
Parameters :					***11.28***				
Sewerage & Sanitation	4.31	1081.97			1718.35	2800.32	4.31	2796.01	0.15
Soil and Water Conservation		3055.97			818.18	3874.15		3874.15	
Fisheries	150 01	2295.01			569.34	2864.36	150.01	2714.35	5.24
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		270.30			352.01	622.31		622.31	
Environ. Forestry and Wildlife	5.28	265.93			180.14	446.07	5.28	440.79	1.18
Agri. Research and Education		353.85			85.59	439.44		439.44	
Special Areas Dev Prog.		516.76			25.11	541.87		541.87	
Flood Control and Drainage		373.10			443.07	816.17		816.17	
Non-Conv. Sources of Energy	0.00	479.09				479.09	0.00	479.09	0.00
Total A	***159.59***	***8691.99***	***0.00***	***0.00***	4191.80	***12883.78***	***159.59***	***12724.19***	***1.24***
Major and Medium Irrigation	371.27	14897.56			16162.21	31059.77	371.27	30688.50	1.20
Minor Irrigation	322.69	4605.18			618.17	5223.35	322.69	4900.67	6.18
Command Area Dev Prog.		1530.96			638.15	2169.11		2169.11	
Total B	***693.95***	***21033.70***	***0.00***	***0.00***	17418.53	***38452.23***	***693.95***	***37758.27***	***1.80***
Total	853.55	29725.68			21610.32	51336.01	853.55	50482.46	1.66
TAMILNADU				1996-97					
Parameters :					***11.46***				
Sewerage & Sanitation	1.33	2061.02			1891.70	3952.72	1.33	3951.39	0.03
Soil and Water Conservation		3149.83			897.72	4047.55		4047.55	
Fisheries	149.77	3584.03			585.12	4169.15	149.77	4019.38	3.59
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		217.00			390.83	607.83		607.83	
Environ. Forestry and Wildlife		309.11			202.11	511.22		511.22	
Agri. Research and Education		371.85			106.02	477.87		477.87	
Special Areas Dev Prog.		696.79			25.52	722.31		722.31	
Flood Control and Drainage		148.48			488.62	637.10		637.10	
Non-Conv. Sources of Energy		253.20				253.20		253.20	
Total A	***151.10***	***10791.31***	***0.00***	***0.00***	4587.65	***15378.96***	***151.10***	***15227.86***	***0.98***
Major and Medium Irrigation	463.72	19012.87			17149.73	36162.60	463.72	35698.88	1.28
Minor Irrigation	270.32	4181.42			899.84	5081.26	270.32	4810.94	5.32
Command Area Dev Prog.		1869.01			723.75	2592.77		2592.77	
Total B	***734.04***	***25063.31***	***0.00***	***0.00***	18773.32	***43836.62***	***734.04***	***43102.58***	***1.67***
Total	885.14	35854.62			23360.97	59215.58	885.14	58330.44	1.49

Basic Source: *Finance Accounts*

*including imputed interest on investment

Notes as in Table A1.

Appendix 3.25: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Tripura

Units in Rs lakh and Recvy. rate in %

TRIPURA				1994-95	effec. int. rate				
Parameters :					*11.13*				
Description	**Rev Rec.**	**Rev Exp.**	**Div.**	**Int.on loans**	**Annualised Cost of Cap.***	**Total Costs**	**Total Rec.**	**Subsidy**	**Recvy. rate**
Sewerage & Sanitation					59.27	59.27		59.27	
Soil and Water Conservation		573.47				573.47		573.47	
Fisheries	19.99	651.65			1.98	653.63	19.99	633.64	3.06
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		256.81				256.81		256.81	
Environ. Forestry and Wildlife	90.77	503.56				503.56	90.77	412.79	18.03
Agri. Research and Education									
Special Areas Dev Prog.									
Flood Control and Drainage		72.55			451.59	524.14		524.14	
Non-Conv. Sources of Energy	0.10	18.44			73.22	91.66	0.10	91.56	0.11
Total A	***110.85***	***2076.47***	***0.00***	***0.00***	**586.06**	***2662.53***	***110.85***	***2551.68***	***4.16***
Major and Medium Irrigation	0.20				1307.05	1307.05	0.20	1306.85	0.02
Minor Irrigation	0.41	1352.24			412.86	1765.10	0.41	1764.69	0.02
Command Area Dev Prog.					5.58	5.58		5.58	
Total B	***0.61***	***1352.24***	***0.00***	***0.00***	1725.49	***3077.73***	***0.61***	***3077.12***	***0.02***
Total	111.46	3428.71			2311.55	5740.26	111.46	5628.80	1.94
TRIPURA				1995-96					
Parameters :					***11.68***				
Sewerage & Sanitation					147.32	147.32		147.32	
Soil and Water Conservation		502.76				502.76		502.76	
Fisheries	17.09	697.77			2.08	699.85	17.09	682.76	2.44
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		98.98				98.98		98.98	
Environ. Forestry and Wildlife	108.76	61.72				61.72	108.76	-47.04	176.22
Agri. Research and Education									
Special Areas Dev Prog.									
Flood Control and Drainage		90.14			505.44	595.58		595.58	
Non-Conv. Sources of Energy		19.08			86.50	105.58		105.58	
Total A	***125.85***	***1470.45***	***0.00***	***0.00***	**741.34**	***2211.79***	***125.85***	***2085.94***	***5.69***
Major and Medium Irrigation	4.41				1413.52	1413.52	4.41	1409.11	0.31
Minor Irrigation	0.89	659.54			426.84	1086.38	0.89	1085.49	0.08
Command Area Dev Prog.					6.80	6.80		6.80	
Total B	***5.30***	***659.54***	***0.00***	***0.00***	**1847.16**	***2506.69***	***5.30***	***2501.39***	***0.21***
Total	131.15	2129.99			2588.49	4718.48	131.15	4587.33	2.78
TRIPURA				1996-97					
Parameters :					***12.97***				
Sewerage & Sanitation					252.69	252.69		252.69	
Soil and Water Conservation		587.30				587.30		587.30	
Fisheries	14.53	727.93			2.29	730.22	14.53	715.69	1.99
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		172.56				172.56		172.56	
Environ. Forestry and Wildlife	3.08	70.97				70.97	3.08	67.89	4.34
Agri. Research and Education									
Special Areas Dev Prog.									
Flood Control and Drainage		114.93			582.10	697.03		697.03	
Non-Conv. Sources of Energy	0.00	18.03			98.13	116.16	0.00	116.16	0.00
Total A	***17.61***	***1691.73***	***0.00***	***0.00***	**935.20**	***2626.94***	***17.61***	***2609.32***	***0.67***
Major and Medium Irrigation	0.29				1595.86	1595.86	0.29	1595.56	0.02
Minor Irrigation	2.45	961.79			459.18	1420.97	2.45	1418.53	0.17
Command Area Dev Prog.					8.26	8.26		8.26	
Total B	***2.74***	***961.79***	***0.00***	*0.00*	**2063.29**	***3025.08***	***2.74***	***3022.35***	***0.09***
Total	**20.35**	2653.52			**2998.50**	**5652.02**	**20.35**	5631.67	**0.36**

Basic Source: *Finance Accounts*
*including imputed interest on investment
Notes as in Table A1.

Appendix 3.26: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

Uttar Pradesh

Units in Rs lakh and Recvy. rate in %

UTTAR PRADESH				1994-95	effec. int. rate				
Parameters :					*12.26*				
Description	**Rev Rec.**	**Rev Exp.**	**Div.**	**Int.on loans**	**Annualised Cost of Cap.***	**Total Costs**	**Total Rec.**	**Subsidy**	**Recvy. rate**
Sewerage & Sanitation		2633.03			423.06	3056.08		3056.08	
Soil and Water Conservation		7937.62			123.66	8061.28		8061.28	
Fisheries	110.92	1402.02			50.67	1452.68	110.92	1341.76	7.64
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		209.54			4.65	214.19		214.19	
Environ. Forestry and Wildlife	68.23	890.90			15.66	906.56	68.23	838.33	7.53
Agri. Research and Education		5.02				5.02		5.02	
Special Areas Dev Prog.		1431.51				1431.51		1431.51	
Flood Control and Drainage		3363.39			6178.79	9542.18		9542.18	
Non-Conv. Sources of Energy	0.23	0.36			0.16	0.52	0.23	0.29	44.39
Total A	***179.38***	***17873.38***	***0.00***	***0.00***	**6796.64**	***24670.03***	***179.38***	***24490.65***	***0.73***
Major and Medium Irrigation	6548.16	55694.62			72043.46	127738.08	6548.16	121189.92	5.13
Minor Irrigation	2794.04	52101.91			21808.02	73909.93	2794.04	71115.89	3.78
Command Area Dev Prog.		3800.69			1035.98	4836.67		4836.67	
Total B	***9342.19***	***111597.21***	***0.00***	***0.00***	**94887.46**	***206484.67***	***9342.19***	***197142.48***	***4.52***
Total	**9521.57**	**129470.60**			**101684.10**	**231154.70**	**9521.57**	**221633.13**	**4.12**
UTTAR PRADESH				1995-96					
Parameters :					*11.31*				
Sewerage & Sanitation		2808.01			459.52	3267.54		3267.54	
Soil and Water Conservation		12129.90			-24.46	12105.44		12105.44	
Fisheries	153.85	1479.05			47.99	1527.04	153.85	1373.19	10.08
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		339.62			4.39	344.01		344.01	
Environ. Forestry and Wildlife	75.39	1191.32			14.81	1206.13	75.39	1130.74	6.25
Agri. Research and Education		65.71				65.71		65.71	
Special Areas Dev Prog.		989.40				989.40		989.40	
Flood Control and Drainage		3933.45			6030.99	9964.44		9964.44	
Non-Conv. Sources of Energy	0.27				0.15	0.15	0.27	-0.12	176.53
Total A	***229.51***	***22936.46***	***0.00***	***0.00***	**6533.40**	***29469.86***	***229.51***	***29240.35***	***0.78***
Major and Medium Irrigation	10395.34	61160.82			71746.54	132907.36	10395.34	122512.02	7.82
Minor Irrigation	4058.29	60971.74			21867.99	82839.73	4058.29	78781.44	4.90
Command Area Dev Prog.		4982.62			964.01	5946.63		5946.63	
Total B	***14453.63***	***127115.19***	***0.00***	***0.00***	**94578.53**	***221693.72***	***14453.63***	***207240.09***	***6.52***
Total	**14683.14**	**150051.65**			**101111.93**	**251163.58**	**14683.14**	**236480.44**	**5.85**
UTTAR PRADESH				1996-97					
Parameters :					*12.32*				
Sewerage & Sanitation		5115.88			499.80	5615.68		5615.68	
Soil and Water Conservation		17744.10			-25.29	17718.81		17718.81	
Fisheries	321.36	1444.14			83.10	1527.24	321.36	1205.88	21.04
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		398.11			4.66	402.77		402.77	
Environ. Forestry and Wildlife	71.58	1224.24			15.71	1239.95	71.58	1168.37	5.77
Agri. Research and Education		9.94				9.94		9.94	
Special Areas Dev Prog.		1106.52				1106.52		1106.52	
Flood Control and Drainage		3964.18			6516.08	10480.26		10480.26	
Non-Conv. Sources of Energy	0.02				0.16	0.16	0.02	0.14	11.34
Total A	***392.96***	***31007.11***	***0.00***	***0.00***	**7094.22**	***38101.33***	***392.96***	***37708.37***	***1.03***
Major and Medium Irrigation	10078.47	61738.03			81536.60	143274.63	10078.47	133196.16	7.03
Minor Irrigation	3675.42	72331.39			22128.25	94459.64	3675.42	90784.22	3.89
Command Area Dev Prog.		4810.72			1072.13	5882.85		5882.85	
Total B	***13753.89***	***138880.13***	***0.00***	***0.00***	**104736.98**	***243617.12***	***13753.89***	***229863.23***	***5.65***
Total	14146.85	169887.24			111831.20	281718.44	14146.85	267571.59	5.02

Basic Source: *Finance Accounts*

*including imputed interest on investment

Notes as in Table A1.

Appendix 3.27: Estimating Environment-Related Budgetary Subsidies : 1994-95 to 1996-97

West Bengal

Units in Rs lakh and Recvy. rate in %

Description	Rev Rec.	Rev Exp.	Div.	Int.on loans	Annualised Cost of Cap.*	Total Costs	Total Rec.	Subsidy	Recvy. rate
WEST BENGAL				1994-95	effec. int. rate				
Parameters :					***11.23***				
Sewerage & Sanitation	0.15	505.54			28.85	534.39	0.15	534.24	0.03
Soil and Water Conservation		1414.30			9.46	1423.76		1423.76	
Fisheries	135.85	2288.44		45.00	324.55	2612.99	180.85	2432.14	6.92
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		659.96				659.96		659.96	
Environ. Forestry and Wildlife	42.99	1416.25				1416.25	42.99	1373.26	3.04
Agri. Research and Education		78.18			5.08	83.26		83.26	
Special Areas Dev Prog.		1461.39				1461.39		1461.39	
Flood Control and Drainage		1530.97			3657.79	5188.76		5188.76	
Non-Conv. Sources of Energy		82.13				82.13		82.13	
Total A	***178.99***	***9437.16***	***0.00***	***45.00***	**4025.73**	***13462.89***	***223.99***	***13238.90***	***1.66***
Major and Medium Irrigation	304.17	7652.56			12324.63	19977.19	304.17	19673.01	1.52
Minor Irrigation	528.75	9939.88			4319.66	14259.54	528.75	13730.79	3.71
Command Area Dev Prog.		138.01			319.52	457.52		457.52	
Total B	***832.93***	***17730.45***	***0.00***	***0.00***	**16963.81**	***34694.25***	***832.93***	***33861.32***	***2.40***
Total	**1011.92**	**27167.61**		**45.00**	**20989.54**	**48157.15**	**1056.92**	**47100.23**	**2.19**
WEST BENGAL				1995-96					
Parameters :					***11.81***				
Sewerage & Sanitation	1.69	695.29			30.35	725.64	1.69	723.96	0.23
Soil and Water Conservation		1279.34			9.82	1289.16		1289.16	
Fisheries	76.09	2694.72		50.78	363.74	3058.46	126.87	2931.59	4.15
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		466.15				466.15		466.15	
Environ. Forestry and Wildlife	32.99	1304.37				1304.37	32.99	1271.38	2.53
Agri. Research and Education		101.12			5.26	106.38		106.38	
Special Areas Dev Prog.		1395.46				1395.46		1395.46	
Flood Control and Drainage		1783.52			4185.32	5968.84		5968.84	
Non-Conv. Sources of Energy		50.92				50.92		50.92	
Total A	***110.77***	***9770.89***	***0.00***	***50.78***	**4594.49**	***14365.39***	***161.55***	***14203.84***	***1.12***
Major and Medium Irrigation	279.85	8562.35			14116.62	22678.98	279.85	22399.12	1.23
Minor Irrigation	505.56	11223.06			4815.94	16039.00	505.56	15533.44	3.15
Command Area Dev Prog.		165.98			371.99	537.96		537.96	
Total B	***785.42***	***19951.39***	***0.00***	***0.00***	**19304.55**	***39255.94***	***785.42***	***38470.52***	***2.00***
Total	**896.19**	**29722.29**		**50.78**	**23899.04**	**53621.33**	**946.97**	**52674.36**	**1.77**
WEST BENGAL				1996-97					
Parameters :					***12.11***				
Sewerage & Sanitation	0.28	1627.38			31.11	1658.48	0.28	1658.21	0.02
Soil and Water Conservation		1795.19			11.40	1806.59		1806.59	
Fisheries	63.37	3612.36			490.63	4103.00	63.37	4039.62	1.54
Forestry and Wildlife									
Forest Cons., Dev., and Regen.		574.55				574.55		574.55	
Environ. Forestry and Wildlife	68.43	1481.36				1481.36	68.43	1412.93	4.62
Agri. Research and Education		84.24			5.35	89.59		89.59	
Special Areas Dev Prog.		1033.83				1033.83		1033.83	
Flood Control and Drainage		1763.98			4785.24	6549.22		6549.22	
Non-Conv. Sources of Energy	0.05	137.15				137.15	0.05	137.10	0.04
Total A	***132.13***	***12110.04***	***0.00***	***0.00***	**5323.72**	***17433.76***	***132.13***	***17301.64***	***0.76***
Major and Medium Irrigation	279.26	9979.03			16093.25	26072.28	279.26	25793.02	1.07
Minor Irrigation	577.51	13016.34			5155.45	18171.78	577.51	17594.28	3.18
Command Area Dev Prog.		195.91			430.61	626.52		626.52	
Total B	***856.77***	***23191.27***	***0.00***	***0.00***	**21679.31**	***44870.59***	***856.77***	***44013.82***	***1.91***
Total	**988.90**	**35301.32**			**27003.04**	**62304.35**	**988.90**	**61315.45**	**1.59**

Basic Source: *Finance Accounts*

*including imputed interest on investment

Notes as in Table A1.

Appendix 4.1

Statewise Subsidies on Environment Promoting Schemes

Rs Crore

	States	Total Subsidies		
		1994-95	1995-96	1996-97
1.	Andhra Pradesh	1312.50	1660.78	2046.81
2.	Arunachal Pradesh	40.27	42.49	45.89
3.	Assam	344.59	305.03	341.53
4.	Bihar	1047.01	1053.45	1148.08
5.	Delhi	9.71	34.79	43.46
6.	Goa	44.09	55.61	64.49
7.	Gujarat	1454.43	1693.39	1938.15
8.	Haryana	799.81	574.70	613.95
9.	Himachal Pradesh	92.98	103.32	103.70
10.	Jammu & Kashmir	225.12	118.99	193.93
11.	Karnataka	1243.03	1416.50	1692.52
12.	Kerala	417.17	464.87	521.06
13.	Madhya Pradesh	1267.91	1429.24	1584.62
14.	Maharashtra	2634.76	3148.79	3864.02
15.	Manipur	69.82	104.08	104.53
16	Meghalaya	29.99	36.06	38.35
17.	Mizoram	17.26	18.29	17.70
18.	Nagaland	16.80	24.38	30.27
19.	Orissa	650.29	719.30	810.09
20.	Punjab	484.43	584.31	688.77
21.	Rajasthan	1087.78	1172.36	1245.62
22.	Sikkim	10.20	11.84	15.47
23.	Tamil Nadu	507.37	504.82	583.30
24.	Tripura	56.29	45.87	56.32
25.	Uttar Pradesh	2216.33	2364.80	2675.72
26.	West Bengal	471.00	526.74	613.15
27.	States and Centre	5320.73	6379.03	6471.29

Basic Source: Finance Accounts

Appendix 4.2

Statewise Recovery Rates on Environment Promoting Schemes (%)

	States	Total Recovery Rate (%)		
		1994-95	1995-96	1996-97
1.	Andhra Pradesh	8.27	6.16	3.76
2.	Arunachal Pradesh	1.32	0.83	0.34
3.	Assam	0.52	0.67	0.49
4.	Bihar	1.76	3.26	3.52
5.	Delhi	8.08	2.05	1.60
6.	Goa	3.37	1.51	1.12
7.	Gujarat	3.21	2.48	2.19
8.	Haryana	2.44	3.68	4.52
9.	Himachal Pradesh	0.98	0.91	1.06
10.	Jammu & Kashmir	0.28	1.08	0.49
11.	Karnataka	1.35	1.47	1.38
12.	Kerala	0.85	0.90	0.80
13.	Madhya Pradesh	3.93	3.20	3.42
14.	Maharashtra	3.35	2.95	1.84
15.	Manipur	1.88	0.51	0.90
16	Meghalaya	0.21	0.17	0.22
17.	Mizoram	0.50	0.26	0.35
18.	Nagaland	0.12	0.34	1.63
19.	Orissa	1.20	2.15	1.26
20.	Punjab	6.56	5.21	4.20
21.	Rajasthan	4.47	4.86	4.62
22.	Sikkim	0.56	0.67	0.33
23.	Tamil Nadu	1.67	1.66	1.49
24.	Tripura	1.94	2.78	0.36
25.	Uttar Pradesh	4.12	5.85	5.02
26.	West Bengal	2.19	1.77	1.59
27.	States and Centre	1.19	0.32	1.03

Basic Source: Finance Accounts

Appendix 4.3 Subsidies as a Proportion of Total Revenue Receipts (%)				
	States	Subsidy as a Proportion of Receipts (%)		
		1994-95	1995-96	1996-97
1.	Andhra Pradesh	14.94	16.82	18.29
2.	Arunachal Pradesh	6.38	5.51	5.67
3.	Assam	11.64	9.04	8.86
4.	Bihar	16.60	14.27	13.65
5.	Delhi	0.49	1.51	1.55
6.	Goa	8.26	6.80	7.96
7.	Gujarat	18.63	19.82	20.05
8.	Haryana	13.60	11.46	10.15
9.	Himachal Pradesh	7.12	5.89	5.21
10.	Jammu & Kashmir	7.29	3.58	6.02
11.	Karnataka	17.84	16.58	17.59
12.	Kerala	8.94	8.57	8.48
13.	Madhya Pradesh	16.64	16.52	15.82
14.	Maharashtra	17.46	19.02	20.07
15.	Manipur	11.79	15.05	12.70
16	Meghalaya	5.66	5.27	5.25
17.	Mizoram	3.32	2.95	2.69
18.	Nagaland	2.71	3.32	3.54
19.	Orissa	18.19	18.49	18.90
20.	Punjab	9.14	11.27	12.37
21.	Rajasthan	17.21	15.37	16.48
22.	Sikkim	1.87	1.26	1.34
23.	Tamil Nadu	5.50	4.76	4.88
24.	Tripura	7.59	4.89	5.47
25.	Uttar Pradesh	16.55	15.54	16.69
26.	West Bengal	6.86	7.14	7.45
27.	States and Centre	3.63	3.78	3.34

Basic Source: Finance Accounts

Appendix 4.4

Subsidies as a Proportion of Total Revenue Expenditure (%)

	States	Subsidy as a Proportion of Expenditure (%)		
		1994-95	1995-96	1996-97
1.	Andhra Pradesh	13.80	15.65	14.22
2.	Arunachal Pradesh	9.19	8.38	7.60
3.	Assam	10.54	8.53	9.56
4.	Bihar	13.84	12.84	12.72
5.	Delhi	0.68	1.85	2.14
6.	Goa	9.24	7.08	8.18
7.	Gujarat	19.28	19.32	18.89
8.	Haryana	12.75	10.72	9.07
9.	Himachal Pradesh	5.76	5.43	4.83
10.	Jammu & Kashmir	8.91	4.23	6.20
11.	Karnataka	17.11	16.70	16.59
12.	Kerala	8.23	7.98	7.68
13.	Madhya Pradesh	16.24	15.65	13.82
14.	Maharashtra	17.79	18.34	18.54
15.	Manipur	13.74	16.82	14.72
16	Meghalaya	6.56	6.21	6.22
17.	Mizoram	3.73	3.24	2.85
18.	Nagaland	2.87	2.92	3.57
19.	Orissa	16.11	15.31	15.83
20.	Punjab	8.02	10.37	9.95
21.	Rajasthan	16.12	14.07	14.78
22.	Sikkim	1.94	1.34	1.38
23.	Tamil Nadu	5.27	4.63	4.46
24.	Tripura	7.98	5.83	6.21
25.	Uttar Pradesh	14.40	13.47	13.93
26.	West Bengal	6.17	6.11	5.92
27.	States and Centre	2.99	3.22	2.86

Basic Source: Finance Accounts

Appendix 4.5

Revenue Expenditure on Environment Promoting Schemes as a Proportion of Total Revenue Expenditure (%)

	States	Rev. Exp. as a Proportion of Total Rev. Exp. (%)		
		1994-95	1995-96	1996-97
1.	Andhra Pradesh	7.99	8.28	7.07
2.	Arunachal Pradesh	8.18	7.34	6.50
3.	Assam	2.79	2.55	2.86
4.	Bihar	3.47	3.57	3.78
5.	Delhi	0.66	0.66	0.54
6.	Goa	2.55	1.84	2.22
7.	Gujarat	10.73	11.03	10.34
8.	Haryana	8.69	5.70	4.65
9.	Himachal Pradesh	3.87	3.60	3.22
10.	Jammu & Kashmir	4.67	1.43	4.38
11.	Karnataka	7.29	6.64	6.85
12.	Kerala	3.56	3.65	3.35
13.	Madhya Pradesh	6.39	6.30	5.81
14.	Maharashtra	9.20	9.31	9.13
15.	Manipur	4.18	4.75	5.79
16	Meghalaya	5.17	5.05	4.76
17.	Mizoram	3.64	3.15	2.75
18.	Nagaland	2.32	2.52	3.25
19.	Orissa	4.54	4.57	5.16
20.	Punjab	2.90	3.51	3.29
21.	Rajasthan	9.00	7.46	6.98
22.	Sikkim	1.74	1.22	1.28
23.	Tamil Nadu	2.88	2.72	2.74
24.	Tripura	4.86	2.71	2.93
25.	Uttar Pradesh	8.41	8.55	8.84
26.	West Bengal	3.56	3.45	3.41
27.	States and Centre	2.55	2.59	2.42

Basic Source: Finance Accounts

Appendix 4.6

Average Revenue Expenditure (1994-95 to 1996-97) on environment Promoting Schemes as a Proportion of Average total Revenue Expenditure (%)

	States	Avg. Rev. Exp. as a Proportion of Total Rev. Ex. (%)
1.	Delhi	0.61
2.	Sikkim	1.35
3.	Goa	2.15
4.	States and Centre	2.51
5.	Assam	2.73
6.	Nagaland	2.74
7.	Tamil Nadu	2.78
8.	Mizoram	3.14
9.	Punjab	3.23
10.	Tripura	3.42
11.	West Bengal	3.46
12.	Jammu & Kashmir	3.49
13.	Kerala	3.51
14.	Himachal Pradesh	3.54
15.	Bihar	3.61
16.	Orissa	4.78
17.	Meghalaya	4.97
18.	Manipur	4.99
19.	Madhya Pradesh	6.13
20.	Haryana	6.33
21.	Karnataka	6.90
22.	Arunachal Pradesh	7.25
23.	Andhra Pradesh	7.70
24.	Rajasthan	7.73
25.	Uttar Pradesh	8.62
26.	Maharashtra	9.21
27.	Guajarat	10.68

Basic Source: Finance Accounts

Appendix 4.7

Statewise Per capita Subsidy (Rupees)

	States	Subsidy (Per Capita) (Rupees)		
		1994-95	1995-96	1996-97
1.	Andhra Pradesh	186.35	231.98	281.84
2.	Arunachal Pradesh	436.76	453.94	434.11
3.	Assam	145.03	126.30	136.76
4.	Bihar	114.29	113.13	122.15
5.	Delhi	9.52	33.49	36.06
6.	Goa	354.13	440.31	453.81
7.	Gujarat	331.86	380.11	422.02
8.	Haryana	457.08	323.10	327.25
9.	Himachal Pradesh	170.73	187.48	170.25
10.	Jammu & Kashmir	277.37	144.93	214.10
11.	Karnataka	260.67	292.22	340.13
12.	Kerala	135.59	148.64	167.08
13.	Madhya Pradesh	180.22	199.85	211.35
14.	Maharashtra	314.91	370.24	442.41
15.	Manipur	356.78	524.07	467.06
16	Meghalaya	158.62	187.89	177.30
17.	Mizoram	234.56	244.82	209.72
18.	Nagaland	129.92	185.65	203.40
19.	Orissa	194.03	211.13	233.70
20.	Punjab	225.26	267.30	305.27
21.	Rajasthan	232.40	246.40	247.62
22.	Sikkim	235.67	269.02	311.80
23.	Tamil Nadu	85.92	84.10	97.50
24.	Tripura	191.59	153.89	167.61
25.	Uttar Pradesh	149.69	157.12	168.93
26.	West Bengal	65.25	71.78	81.45
27.	States and Centre	59.25	69.88	68.60

Basic Source: Finance Accounts

Appendix 4.8

Average Subsidy (1994-95 to 1996-97) as a Proportion of Total Revenue Expenditure (%)

	States	Average Subsidy as a Proportion of Total Rev. Ex. (%)
1.	Sikkim	1.48
2.	Delhi	1.65
3.	States and Centre	3.02
4.	Nagaland	3.15
5.	Mizoram	3.23
6.	Tamil Nadu	4.75
7.	Himachal Pradesh	5.30
8.	West Bengal	6.05
9.	Meghalaya	6.31
10.	Jammu & Kashmir	6.35
11.	Tripura	6.60
12.	Kerala	7.94
13.	Goa	8.01
14.	Arunachal Pradesh	8.30
15.	Punjab	9.45
16.	Assam	9.51
17.	Haryana	10.81
18.	Bihar	13.10
19.	Uttar Pradesh	13.91
20.	Andhra Pradesh	14,54
21.	Rajasthan	14.92
22.	Madhya Pradesh	15.08
23.	Manipur	15.15
24.	Orissa	15.74
25.	Karnataka	16.77
26.	Maharashtra	18.26
27.	Gujarat	19.14

Basic Source: Finance Accounts

Appendix 4.9

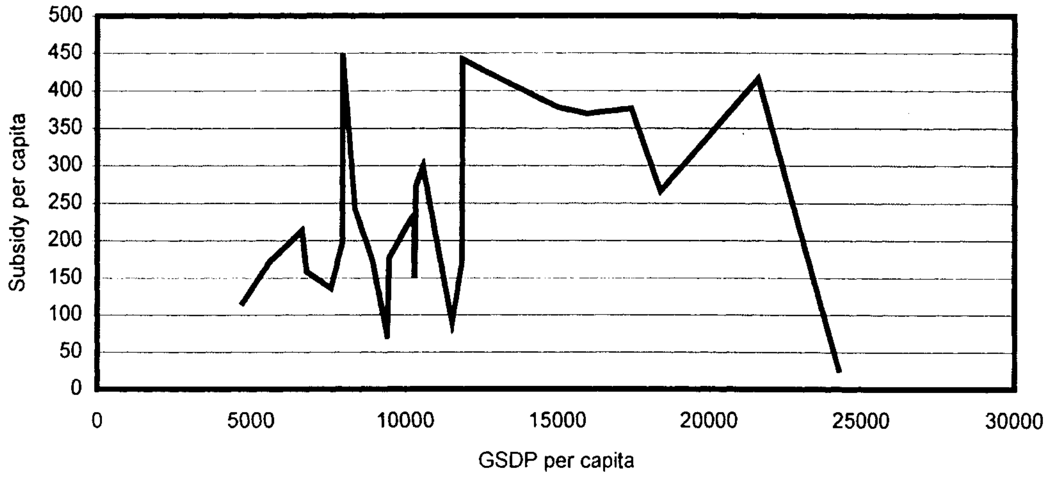
Statewise Per capita Revenue Expenditure on Environment Promoting Schemes (Rupees)

	States	Revenue Expenditure. (Per Capita) (Rupees)		
		1994-95	1995-96	1996-97
1.	Andhra Pradesh	107.99	122.68	140.15
2.	Arunachal Pradesh	388.77	397.82	371.44
3.	Assam	38.45	37.82	40.90
4.	Bihar	28.67	31.44	36.26
5.	Delhi	9.21	11.84	9.18
6.	Goa	97.92	114.50	123.34
7.	Gujarat	184.65	216.96	230.97
8.	Haryana	311.50	171.87	167.75
9.	Himachal Pradesh	114.84	124.51	113.49
10.	Jammu & Kashmir	145.37	49.11	151.21
11.	Karnataka	111.03	116.19	140.37
12.	Kerala	58.56	68.00	73.01
13.	Madhya Pradesh	70.87	80.48	88.81
14.	Maharashtra	162.82	188.04	217.93
15.	Manipur	108.50	147.87	183.77
16	Meghalaya	124.93	152.81	135.67
17.	Mizoram	228.54	238.24	202.65
18.	Nagaland	105.05	160.12	184.89
19.	Orissa	54.61	63.03	76.16
20.	Punjab	81.39	90.53	101.00
21.	Rajasthan	129.73	130.57	116.96
22.	Sikkim	211.86	244.66	287.70
23.	Tamil Nadu	47.07	49.52	59.93
24.	Tripura	116.70	71.45	78.97
25.	Uttar Pradesh	87.44	99.70	107.26
26.	West Bengal	37.63	40.50	46.89
27.	States and Centre	50.38	56.23	58.00

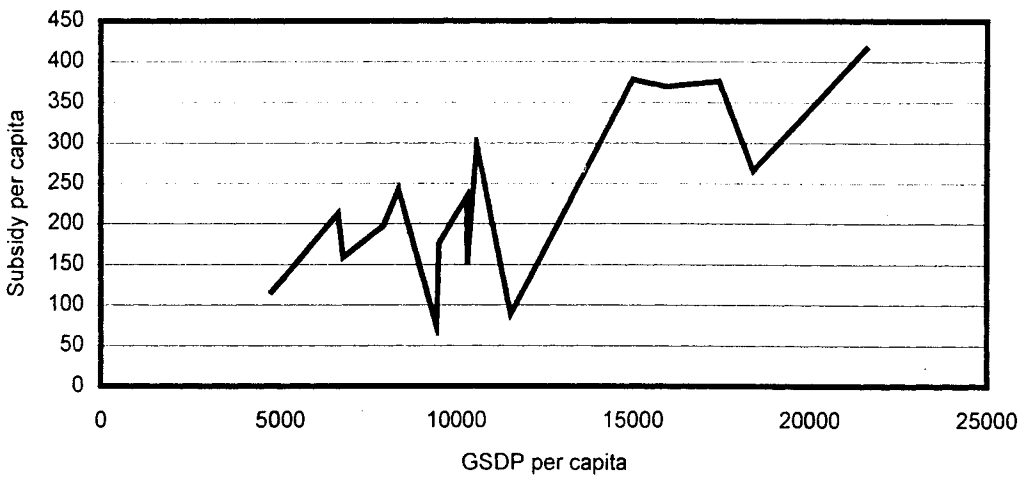
Basic Source: Finance Accounts

Appendix 5.1

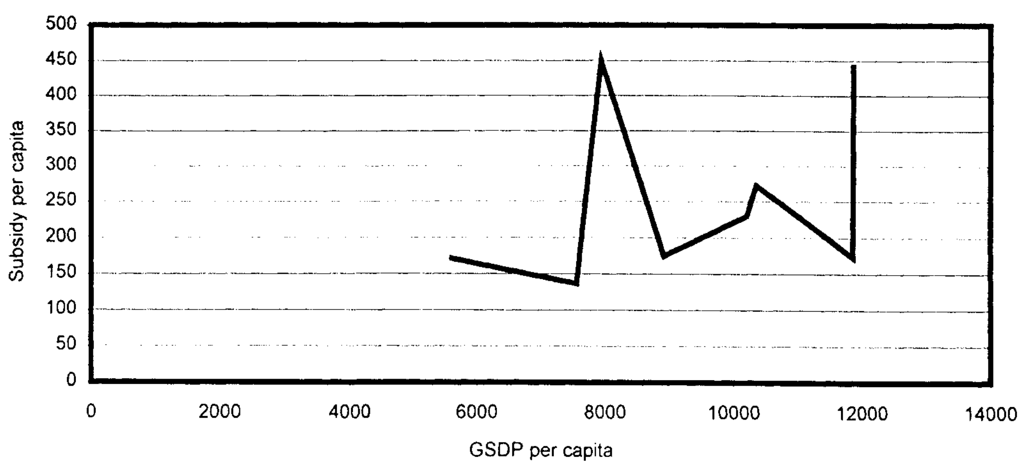
Subsidy - Income (per capita)



Subsidy - Income (per capita) of other states

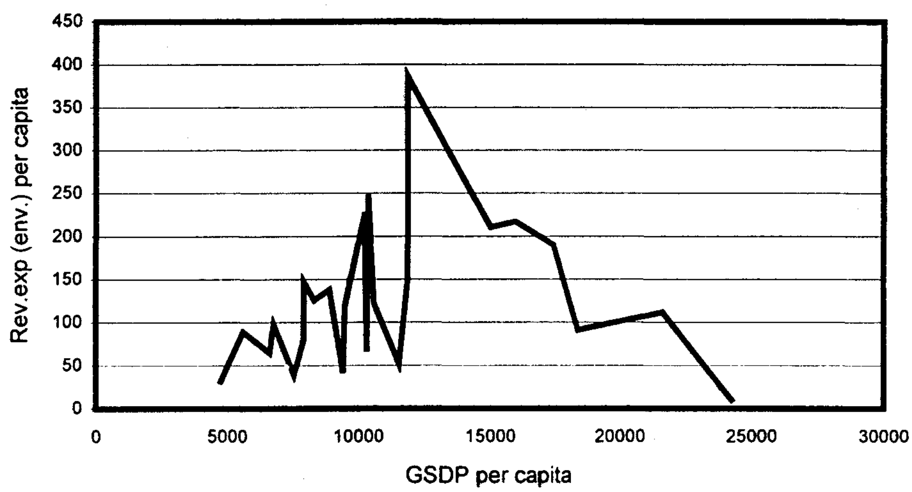


Subsidy - Income (per capita) of NE states

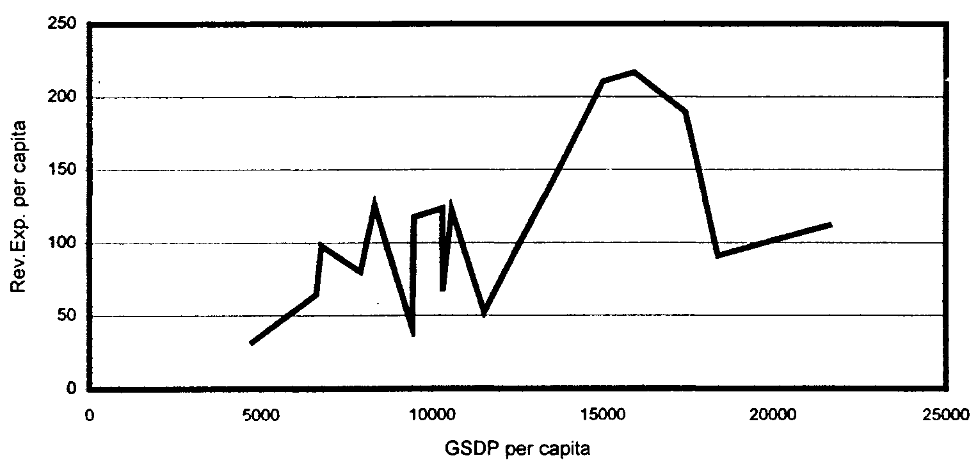


Appendix 5.2

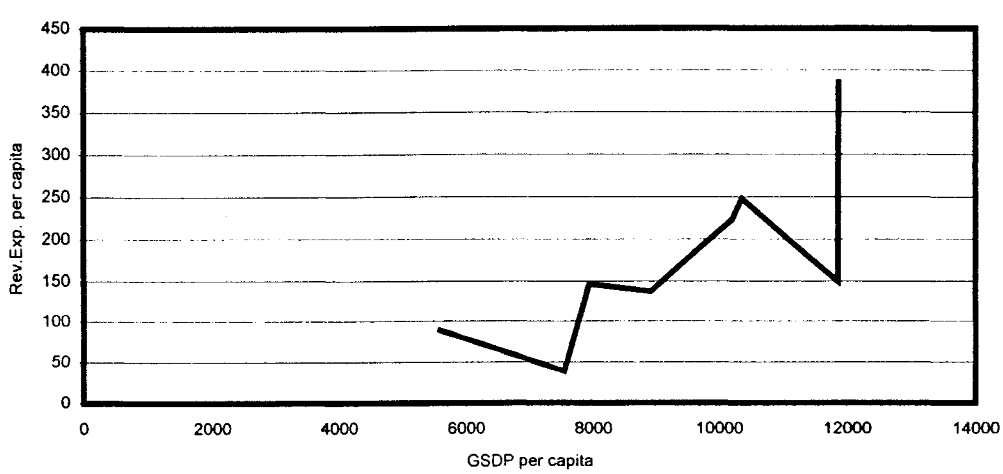
Rev.exp - Income (per capita)



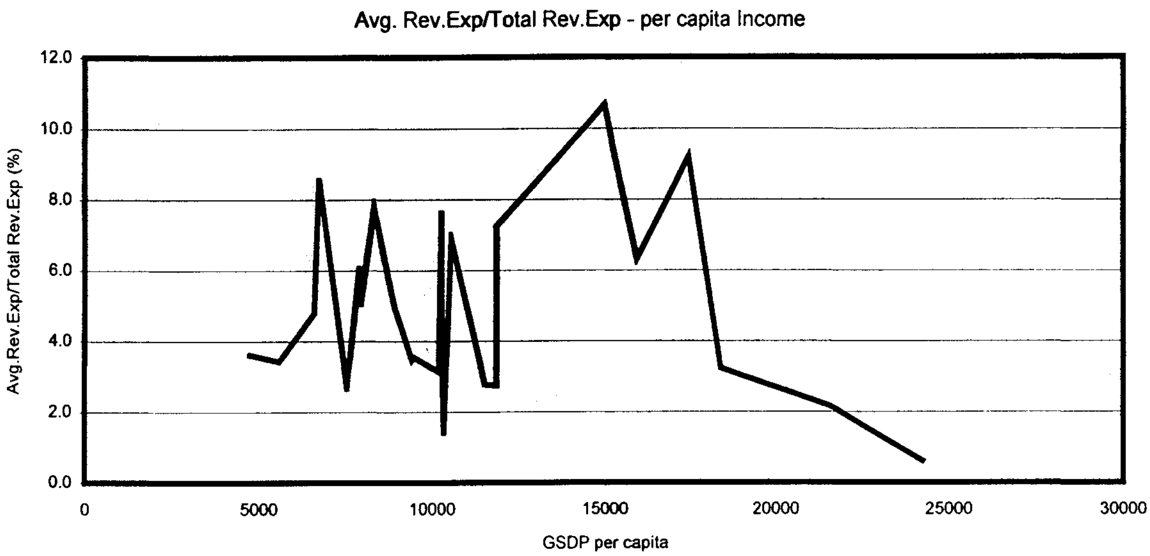
Rev. Exp. - Income (per capita) of other states

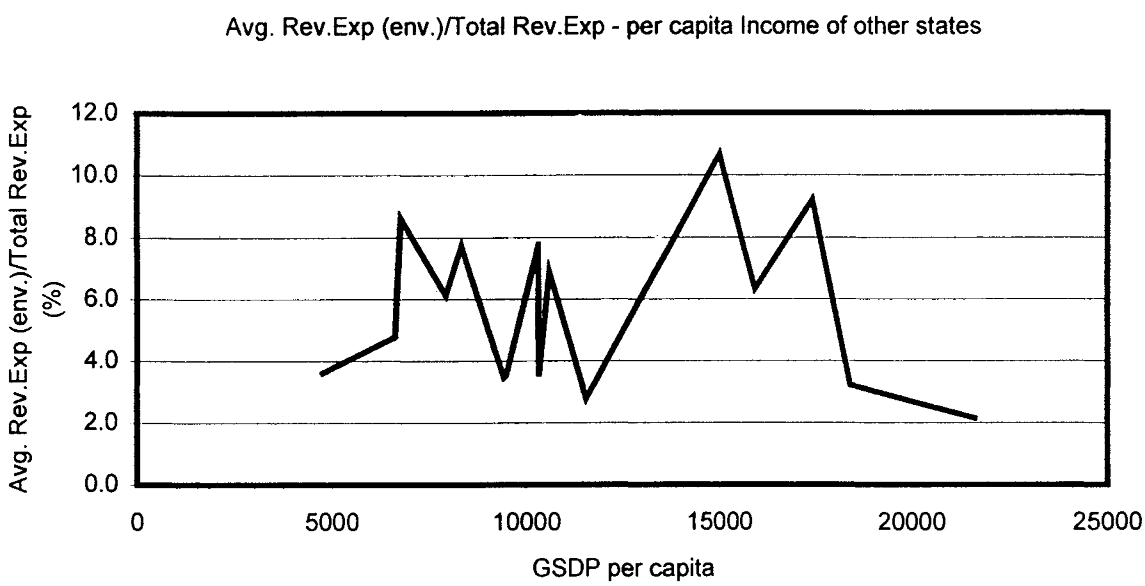


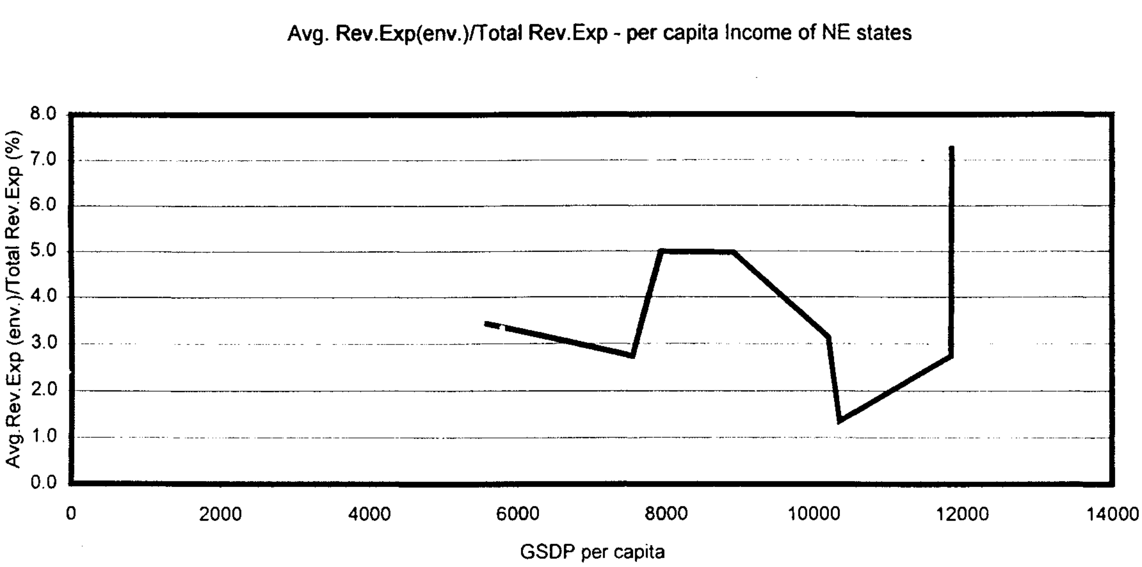
Rev. Exp. - Income (per capita) of NE states



Appendix 5.3

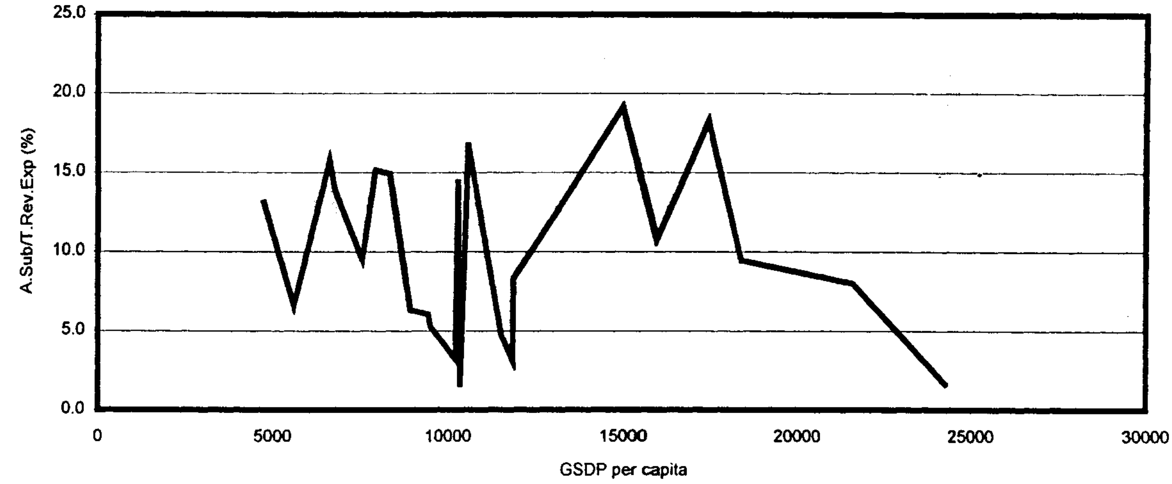

Avg. Rev.Exp/Total Rev.Exp - per capita Income
Avg.Rev.Exp/Total Rev.Exp (%)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
5000
10000
15000
20000
25000
30000
GSDP per capita


Avg. Rev.Exp (env.)/Total Rev.Exp - per capita Income of other states
Avg. Rev.Exp (env.)/Total Rev.Exp (%)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
5000
10000
15000
20000
25000
GSDP per capita

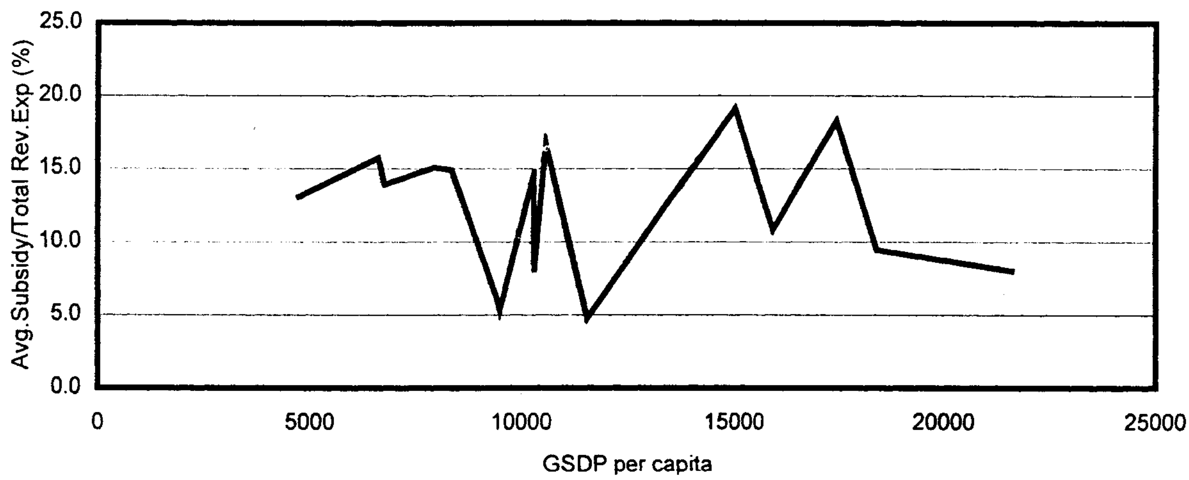

Avg. Rev.Exp(env.)/Total Rev.Exp - per capita Income of NE states
Avg.Rev.Exp (env.)/Total Rev.Exp (%)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
2000
4000
6000
8000
10000
12000
14000
GSDP per capita

Appendix 5.4

Avg.Sub./T.Rev.Exp - per capita Income



Avg.Subsidy/Total Rev.Exp. - per capita Income of other states



Avg. Subsidy/Total Rev. Exp. - per capita Income of NE states