Chapter 1
Introduction

1.1 Introduction

Economic development has reached a new dimension and the present paradigm is ‘Sustainable Development’. The new generation of economic theorists concentrates on ecologically friendly and environment-supporting models of development. Theoretical issues relating to the environmentally friendly economic development are discussed in environmental economics which is a fast growing branch of general economics. The growing relevance of this subject can be seen from the fact that the scarcity of environmental goods increases over time. The present pattern of economic growth has ended up in the deterioration of the quality of our environment. In recent economic literature, environmental quality is described as a non-marketed (Vincent 1) public good (Purkayastha and Ashokanandha 49). Hence immediate action needs to be launched for ensuring the benefit of environmental services for all.

1.2 Sustainable Development: Evolution of the Concept

The question of sustainability and the carrying capacity of this planet became a matter of heated debate since the Stockholm Conference 1972 and the publication of “The Limits to Growth” by the team headed by Meadows. The idea gained further ground with the appointment of the
World Commission on Environment and Development called Brundtland Commission and the publication of its report ‘Our Common future’ in 1987. Later, the issue was further discussed, elaborated and confirmed by the ideas involved in ‘Our Common Future’ in the Rio Earth Summit 1992 and the Johannesburg Earth Summit 2002. Now, the question of sustainability is deeply felt everywhere and efforts are being made to accomplish its goals. Very often, the pre-fix “sustainable” is now being invariably used before terms relating to various aspects of human engineered development.

1.3 Sustainable Development: The Concept

The concept of sustainable development is not enough precise to delimit its boundaries. Economists like J. S Mill, David Ricardo, and T. R Malthus talked about sustainability much before the present generation started evolving a conscientious definition of sustainable development. The most widely quoted definition of sustainable development is from the World Commission on Environment Development in 1987. For them, “sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Gopal 31).

A UNESCO statement says that “every generation should leave water, air and soil resources as pure and unpolluted as when it comes on
earth” (Solow 270). Alternatively, it was suggested that “each generation should leave undiminished all the species of animals it found on earth” (Solow 272). Therefore, the notion of sustainability is about our obligation to the future generations. Does this obligation mean that we must refrain from making permanent construction, building roads, dams etc? Never. As U. Sankar rightly points out “It is an obligation to…preserve the capacity to be well off, to be as well of as we” (14). Hence it is a matter of inter-generational equity. Equity is to be maintained over generations in respect of both the quantity and quality of environmental resources as well as services. Future generations should be able to breathe at least the same quality air as we breathe. In the same fashion, the quality of water and soil resources should be kept undiminished for future generations. Our Children must at least get the same quantity of crude oil as we make use of it for our present use. We should preserve the land potential or fertility which our ancestors left for us, for the coming generations. The land should provide enough food, comfortable shelter and it must contain pure water in sufficient quantities and must be covered with clean breathable air for all humans and living creatures who are expected to be the inheritors of this planet during coming centuries.
Though this definition is meant to grow beyond the narrow national interest and nationalism, the developing countries started looking at it as a definition suited to and made for the developed countries. The emphasis is given for inter-generation equity rather than intra-generation equity. However, intra-generational equity is also to be ensured.

Some doubts may arise about the implications of the phrase ‘as well off as we’. Here the well being of the present generation is very important in determining what we should leave for future generations. Of course, it does not mean that we must leave the adversities which we suffer from the present pattern of development to the future generations. If rivers in Kerala are contaminated, we shall not, definitely leave it to our children. Instead, our policy must be to reduce the contamination levels in the rivers of Kerala.

One can give a ‘strong’ as well as a ‘weak’ interpretation to the process of achieving sustainability. The strong interpretation of sustainability implies a situation in which environmental wealth should remain unaltered from generation to generation. However, the weaker interpretation of sustainability insists that the depletion of environmental wealth must be compensated for by building up other forms of wealth (Titenberg 96 - 98). This also implies that man-made capital and environmental capital are substitutes. There are two kinds of wealth-
human-made and environmental. Human-made wealth is the stock of machinery and infrastructure built by humans as well as the stock of knowledge and skills. Environmental wealth consists of the earths’ renewable and non-renewable resources (Titenberg 96 - 98).

None can underestimate the scope of technical change in maintaining sustainability. One cannot argue for the preservation of particular species of fish or owl only in the name of sustainability. This is true in production also. We need not preserve one particular input for maintaining sustainable production nor do we preserve a particular variety of crops or even plants. If technology permits, one input may be substituted for another keeping production undiminished in quantity and quality. To quote Solow:

In making policy decisions we can take advantage of the principle of substitutability, remembering that what we are obliged to leave behind is a generalized capacity to create well-being, not any particular thing or any particular natural resource. (Solow 272)

Sustainability is not only a matter of inter-generational equity but also a matter of intra-generational equity. The major driving force behind non-sustainable practices is the knowledge that it is possible to make profit at the cost of others. Here the term ‘others’ not only implies future generations but also our contemporaries and the environment as well.
1.4 Sustainability: The Market or the Government?

One of the crucial questions that relate to establishing the inter-generational equity is who will monitor equity over generations: the market or the government? The first option that the market will maintain equitable distribution between the present and future generations, to a large extent depends upon whether all generations, present and future can be represented in the market. As R.M Solow rightly observed, the value of many economic activities which we engage in for our satisfaction as well as for the future generations is not directly quantifiable in money terms due to externalities. The social value of such activities may be different from that of its monetary value to the individual. Hence market is not a suitable and reliable mechanism for valuing such economic activities as contain the seeds of environmental degradation or improvement. Put differently, the demand and supply functions do not reflect the true social benefits and social costs that a particular commodity presents to the society. Moreover, the market functions primarily based on the purchasing power. The demand for environmental amenities of the future generations as well as the poorer sections of the present generations is not properly represented in the market as demand for these environmental goods. The poor people are not having enough purchasing
power whereas the concern for future generations is an unrealised dream of the present. Hence the desires of future generations and the poorer sections of the present are not properly represented in the market. Put differently, the free play of market is unable to resolve the sustainability issue and maintain inter-generational and intra-generational equity. However, “in principle, government could serve as a trustee, as a representative for future interests. Policy actions, taxes, subsidies and regulations could, in principle, correct the excessive present mindedness of ordinary people like us in our daily business” (Solow 273). But still it is quite uncertain whether the government policy will do a good job. Here arises the significance of a democratic set up to discuss and solve these problems.

1.5 The Saving Investment Approach to Sustainability

Sustainability, as a matter of distribution between the future and present, becomes a problem about saving and investment. It becomes a problem about the choice between current consumption and providing for the future. “Sustainability as a matter of choice of how productive capacity should be shared between us and them” (Sankar 14). Sustainability may be measured in terms of the stock of capital. Sustainability from this angle requires that the total stock of capital which
consists of both natural as well as man-made must be non-declining over time.

One vital question that poses against the saving investment argument is in the case of poor countries especially of the poor people. Even the poor people in advanced countries may not be able to follow the rule suggested for sustainable development. The Keynesian tradition of consumption theory does not support the saving and investment argument for maintaining sustainable development in poor countries. The value of Marginal Propensity to Consume (MPC) in respect of these people is much higher, approximately equal to one comparing to that of their counterpart, the affluent countries and affluent sections of people in poor countries. Definitely, poor people will marginally spend more on consumption rather than on investment from every increase in income. It is quite humane to think more consumption will enhance the social welfare of a poor society. But the sustainability erodes. How one can resolve this issue is a Herculean task; though not intellectually but practically. This kind of arguments reminds us that the existence of poverty is detrimental to the idea of sustainability itself. This is a warning to those who are terribly concerned with future sustainability but are not terribly concerned about the poor people today. This situation turns out to be a paradox.
This paradox arises because of the fact that the concern about the poor people will be translated into an increase in current consumption, not into an increase in investment. Income generating programmes though directly linked to investment projects will not create further investment from the generated income. To put differently, there exists a trade off between the income generation and the base of income generation, the total stock of capital. As income increases, the base of income generation depletes, but not replaced among the poor people. The logic of sustainability says, “you ought to be thinking about poor people today, and thinking about poor people today will be disadvantageous from the point of view of sustainability” (Solow 277).

1.6 Sustainability and Population Growth

Rapid growth of population fundamentally is a third world phenomenon. For example, 17 per cent of the world population resides in India and it is ranked as the second populous country next to china in the world. In poor countries, for most of the people, children are insurance against their old age. Control of population growth would be probably the best available policy on behalf of sustainability in these countries. But in poor countries, people are not ready to control the growth of population. For example, in India during the six year period (2000-01 to 2006-07)- after the last census in 2001, 103 million people are added to the existing
stock of 1019 million (Economic survey, 2007-08). The people are not aware of the evil consequences of rapid population growth. Even though they know about it, economic conditions are not conducive to reducing child birth. For example, the poverty ratio in India is remaining as high as 21.8 per cent of the total population (Economic survey, 2007-08).

An increase in population increases the pressure on natural resources and forests and ends up in its depletion as people in poor countries largely depend on natural resources and forests for their livelihood. For example, overgrazing, excessive extraction of forest products including timbers and careless soil tillage, result in rapid destruction of grazing land, deforestation and soil erosion and depletion of soil nutrients.

1.7 The Resource Base of Rural Production

People in poor countries are for the most part agrarian and pastoral folk. WDR 2008 releases information as:

Agriculture is the source of livelihoods for an estimated 86 per cent of rural people. It provides jobs for 1.3 billion smallholders and landless workers, ‘farm-financed social welfare’ when there are urban shocks, and a foundation for viable rural communities. Of the developing world’s 5.5 billion people, 3 billion live in rural areas, nearly half of humanity. Of these rural inhabitants an
estimated 2.5 billion are in households involved in agriculture and 1.5 billion are in smallholder households. (3).

This section of population is the low income category. The WDR 2008 says it thus:

Three of every four poor people in developing countries live in rural areas-2.1 billion living on less than $2 a day and 880 million on less than $1 a day-and most depend on agriculture for their livelihoods (1)

The WDR 2008 further elaborates:

Two thirds of the world’s agricultural value added is created in developing countries. In agriculture-based countries, it generates on average 29 per cent of the gross domestic product (GDP) and employs 65 per cent of the labor force” (3).

In Kerala, about 74 per cent of the total population of 318.41 lakhs was residing in rural areas (Economic Review 41).

These countries and sections of poor people depend mostly on natural resources such as soil and its cover, water, forests, animals and fisheries at their reach for their production activity, directly or indirectly. The poor countries remain poor because the resource base of production in these countries has been neglected for the last fifty or sixty years. Dasguptha rightly observed:
Nevertheless, if there has been a single thread running through forty years of investigation into the poverty of poor countries, it has been the neglect of this base. Environmental resources make but perfunctory appearances in government planning models, and they are cheerfully ignored in most of what goes by the name ‘development economics’. These resources appear in the literature about as frequently as rain falls on the Thar. (338).

“Ignore the environmental base and we will obtain a misleading picture of productive activity within rural communities of poor countries” (Dasguptha 338). Environmental degradation first of all hits very hard the poorer and weaker sections of the society. It mostly affects women, children, and casual labourers and so on. For the poor people in developing countries, natural resources supplements to income. Depletion of such resources badly affects the living conditions of the people even at the vicinity of moderate growth.

It is to be admitted that environmental resources into economic modeling causes a number of additional, potent complications for development policy. These occur because, for poor people in poor countries, some environmental resources are often complementary to other goods and services, while other environmental resources supplement income, most especially in times of acute economic
stress. So an erosion of the environmental resource base can make certain categories of people destitute even while the economy on average grows (Dasguptha 343)

1.8 Sustainability: Resource Degradation

Environmental deterioration which contains all sorts of damage to the life supporting systems is the single most important factor that poses a threat against the sustainability of this planet. “Environmental problems are almost always associated with resources that are regenerative but which are in danger of exhaustion from excessive use” (Dasguptha 339). The arable land is a paradigm of this kind of resource. The potential of land may deteriorate due to excessive as well as unwarranted use. The regeneration or quality improvement of land depends upon the current state of land fertility and the rate of excessive as well as unwarranted use. One of the major reasons of over use is the population growth. Another face of over-use of land and unwarranted practices on it may be seen from the sharply fluctuating prices. Soils are degraded as a result of overusing, overgrazing, intensive cultivation, excessive use of chemical fertilisers, pesticides, deforestation etc. This causes the quality of land to deteriorate, until eventually it produces nothing to the livelihood of human beings.

The symbiotic relationship between soil quality and vegetation cover is crucial for the deterioration of the land fertility. But present
agricultural practices contribute to soil erosion in a big way. “Soil erosion can result in productivity losses as high as 2-3 per cent a year”12 (WDR 16).

Environmental quality, here productivity of land, is in the nature of a non-market, or un-priced, production input. Damage to the environment reduces the supply of this input, and as a result production falls. Conversely, programmes to improve environmental quality can benefit environmentally sensitive forms of production by raising the supply of such inputs (Vincent 1).

1.9 Environmental Degradation and Displacement

Environmental degradation, in the final stage leads to the exodus of people from those areas to unexploited green areas for food, water and shelter. Environmental refugees are often characterised by homelessness and dislocated family. Unless it is checked in time, it may result in further degradation. Moreover, the worsening condition of the poor gradually turns into violence, unethical or misuse of children and girls.

The degree to which a nation or region can prosper depends upon its productivity, which is the efficiency with which it is able to utilise the resources of the environment to satisfy human needs and expectations. If the gains in productivity are to be sustained, resources must also continue to be available over time. This
requires that while providing for current needs, the resource base
has to be managed so as to enable sustainable development.
(Prasad Singh 20)

This basic approach was applied in the 7th plan. The basic approach
to the 7th plan was thus to accelerate sustainable development in harmony
with the environment (Government of India, 7th Five Year Plan, 1985).
This implicitly states the mutual relationship and interdependence
between the counters of environment and the levels of development.
“Proper harnessing of the neglected indigenous technology or traditional
wisdom originating from the people in the countryside can retrieve the
deteriorating situation” (Purkayastha 13).

1.10 The Environment Policy

Environmental policy is important for environmental protection
because we make profit by burdening the environment. Therefore we
should frame due policies that protect our environment. Current
environmental protection contributes to sustainability if it comes at the
expense of current consumption. One of the crucial questions that the
policy makers must consider is whether we make due investments in lieu
of using resources currently available. Here, a distinction is to be made
between replaceable and non-replaceable resources. Environment
protection policy which consists of present investment is essential for
replacing the renewable resources exhausted. The same policy is congenial for making substitutes in case of non-renewable resources. The substitute need not be the same item or a perfect substitute of the irreplaceable resource we use up. According to Solow, “a correct principle, a correct general guide is that when we use up some thing” that is irreplaceable, “whether it is minerals or a fish species, or an environmental amenity, then we should be thinking about providing a substitute of equal value, and the vagueness comes in the notion of value” (Solow 274-275). The something that we provide in exchange could be knowledge, could be technology. It need not even be a physical object. If we funnel the return from using a non-renewable resource into capital formation – plant and equipment, research and development, economics or environmental investments – we are on the right track.

1.11 Review of Literature

U. Sanker’s book, “Environmental Economics” deals with the environmental issues under the purview of Environmental Economics which is an emerging branch of economics at present. The importance of this newly emerging branch of economics is more significant now than ever because the present pattern of development and its inevitable consequences are detrimental to the existence of humanity. “Many environmental goods, which were once regarded as free goods, have now
become scarce resources” (1). Abundance, which was the characteristic feature of nature, has now become scarce as this characteristic due to human activities. The resources and especially its quality which are imperative for the survival of humans and other organisms on this planet are fast depleting and eroding. Unless, we take immediate action to prevent the deterioration of environmental quality, sustainable development may not be possible and feasible.

The question of sustainability is now deeply felt and it is complex. “The combination of deep feelings and complexity breeds buzzwords, and sustainability has certainly become a buzzword” (Solow 269). The development scientists world over are unanimous in demanding the implementation of development models which sustain over time.

T.V Muralivallabhan in his book “Dimensions of Sustainable Economic Development” and R. M Solow in his paper titled “Sustainability an Economist’s Perspective” discuss the role market in allocating environmental resources and solving the environmental degradation problem that the world is facing. The way, by which resource allocation is done in a capitalist economy, resorting to ‘price mechanism’ or market mechanism has nothing to do with the question of inter-generational as well as intra-generational equity in resource allocation as the future generations as well as the poorer sections of the present
generations are not duly represented in the market. “They do not participate in it, and therefore there is no doctrinaire reason for saying, oh well, ordinary supply and demand, ordinary market behaviour, will take care of whatever obligation we have to the future” (Solow 273). The role of the government in protecting the ecology, environment and nature is all the more implicit.

The major driving force behind non-sustainable practices is the knowledge that it is possible to make profit at the cost of others. Here the term ‘others’ not only implies future generations but our contemporaries and the environment as well. In a word, “we free ride on each other and we free ride on the future” (Solow 273). Those who free ride on each other and on the future are termed as “rational” in the current economic literature. But actually they might be termed as “greedy and selfish”, in the sense that they consider a personal gain of Re.1 is much greater than a loss of Rs.100 for the society and future generations.

Dasguptha examines the prime reason for the continuing poverty in the world even after tremendous growth of income in his paper “Poverty and the Environmental Resource Base”. The poor countries remains poor because the resource base of production in these countries has been neglected for the last fifty or sixty years. Ignoring the environmental base we obtain only a misleading picture of productive activity within rural
communities of poor countries. Environmental problems are almost always associated with resources that are regenerative but which are in danger of exhaustion from excessive use.

Environmental degradation first of all hard hits the poorer and weaker sections of society. It mostly affects women, children, and casual labourers and so on. Mrs. Indira Gandhi made this point vivid at the United Nations Conference on Human Environment held in Stockholm in 1972 when she described ‘poverty as the greatest pollutant’ (Swaminathan 56). Many occasions, poverty was responsible for fast growth of population leading to extension of agricultural land into protected green cover and over-exploitation of forest and common property resources.

However, there remains a paradox in resolving the twin problems of poverty and sustainability. Poverty eradication in a short time perspective involves promoting current consumption which curtails current investment. Current investment is essential for the preservation of the natural and environmental resource base for undiminished production for over generations. This paradox arises because of the fact that the concern about the poor people will be translated into an increase in current consumption, not into an increase in investment.
Soil erosion and degradation is the major cause of depletion and degradation of the natural resource base of rural agricultural production. Soils are degraded due to the stress factors viz. overgrazing, intensive cultivation, excessive use of chemical fertilisers, pesticides, flood, irrigation, deforestation etc. This causes the quality of land to deteriorate, until eventually it becomes a waste land. This finding contradicts the usage of the phrase ‘original and indestructible powers of the soil’ used by Ricardo. In actual practice what is going on in many farm-lands is that the potential of land has been deteriorating. The loss of natural capital – soil, water and forest was greater in developing countries. In India, the loss of top soil due to soil erosion is 6000 million tons a year and the cost of nutrients (fertilisers) washed away with it is estimated at Rs.7000 million (Purkayastha 119). Soil erosion leads to an enormous loss of nutrients. According to Swaminathan the annual loss of soil due to erosion is about 6000 million tonnes and that of nutrients is 2.5 million tonnes of nitrogen, 3.3 million tonnes of phosphorus, and 2.6 million tonnes of potash (22).

Scientific advances made on agricultural front have culminated into Green Revolution, during 1960s which has, then, not only neutralised the adverse impacts of population explosion but has created sufficient food reserves in the country. For sustainable development of agricultural
sector, the technologies adopted should be able to accentuate more efficient utilisation of high productivity and better crop production and protection methodologies. Over the years, the fertiliser consumption in the country has increased from 0.1 million tones in 1950 to about 12 million tones in 1992-93. The steep hike in fertiliser consumption during the period 1965-84 was mainly attributed to the introduction of High Yielding Verities and bringing more area under cultivation. Indeed the time then is some times referred to as the “chemical age of agriculture” (Bhan and others 45). It is essential that environmental perspectives become a vital element in our endeavour to increase agricultural productivity. The strategy should be to transform agriculture into a powerful vehicle for both poverty alleviation and environmental conservation (Elizabeth Dowdeswell, Editorial, GEO-4 UNEP).

The economies of India and China (the chunk area of the developing world) are fast growing, the former has a growth rate near double digit and the latter has crossed the double digit target. This is reasonable for them because one third of the population of these countries was deprived of basic amenities of life, including sufficient food to eat. However, it has been argued that much of the growth rate was achieved at the expense of environmental degradation. Excessive growth of
population, craze for short cut industrialisation and high input based commercial agriculture for export have accounted for economic cost which amounts to 3-8 per cent of GDP. This simply means that the real growth rate in China was much lower than the double digit growth rate. In India, the costs of environmental degradation were estimated at 4.5 per cent of the GDP in 1992 (Purkayastha 119).

“Environmental degradation, in its worst stage may create refugees called environment refugees” (Purkayastha 127). The famous ecologist Norman Myers of the Oxford university estimates that currently 25 million people world wide (mostly from poor countries) have been uprooted for environmental causes which exceed the 22 million refugees from civil war and persecution (Purkayastha 127).

In essence, we are talking about production and consumption patterns with a concern about the use of natural and environmental resources for the present and the future. The concern is about both the levels of living and maintenance of natural resources, both over time. Such an objective calls for a design of policies that maintain a stream of benefits from natural resources constantly over a long-period of time. Campbell states that “the old role of developing technologies for farmers seems to clash with the logic of providing farmers with the adaptive skills
to practice ecologically sound farming, while a new role [for research] …seems not to have clearly emerge” (232-249).

It has been observed that the operations of the government machinery are insufficient to prevent the activities that promote environmental degradation in Kerala.

A major cause of environmental degradation today is the lack of integrated environmental planning. Often, departments, municipalities, local authorities and industries use environmental resources according to the priorities of their individual sectors, without much regard to the overall needs of the state or the unsustainable use of its resources” (Economic Review 169).

The State Environment Report of Kerala-2007 warns that:

“The land is subjected to undesirable practices and hence to serious degradation in Kerala.” Hence, “preventive and curative measures against pollution and contamination of soil and land are higher priority in the years to come” (Economic Review 173).

Pepper is the principal crop in the Idukki district (82316 ha) followed by Cardamom (32856 ha), coconut (24274 ha) and tea (23702 ha). During 2003-04, pepper cultivation in the district spread over 82316 ha which constitute around 35 per cent of the total area of pepper cultivation in the state of Kerala (Panchayath Level Statistics, 13).
However there are discrepancies in the statistics of area under pepper cultivation. The Expert Committee appointed for studying the agricultural crises in the Idukki district found that the area under pepper cultivation has declined from 84000 ha to 52000 ha in 2006. In the meantime production has decreased from 65330 tons to 23000 tons (Report submitted to the Central Government by the Expert Committee, Malayala Manorama Daily, dated 1.3.2008).

The reasons of agricultural productivity decline in the Idukki district as stated above has not been yet studied. The immediate impact of this phenomenon will be on incomes of people who mostly depend on income from agricultural production. In the view of sustainable development, especially sustainable agriculture, the productivity decline is studied under the title “Economics Environmental Potential and Sustainable Agricultural productivity- A Case Study of Idukki District”.

1.12 Objectives of the Study

Every human engineered activity, therefore, must conform to the overall sustainable development perspective of the country and the state of Kerala in particular. The major objective of this study is to examine the conditions of sustainable agriculture in the broader perspective of the national policy of sustainable development and to examine the various aspects of sustainable agriculture such as the productivity in farmlands
and factors affecting productivity in the survey area. The practices followed by the farmers in the survey area have a strong bearing on the productivity level. The environmental issues that might be the result of farm practices such as the application of organic as well as inorganic fertilisers and soil erosion need to be addressed. This study is designed to serve the following specific objectives.

1. To identify the sustainable and non sustainable agricultural practices in the survey area
2. To calculate the response of long-run productivity of output to continuous application of chemical fertiliser inputs and soil erosion.
3. To estimate the Average Willingness to Compensate Deterioration (WTCD) for making the land as productive as before and factors determining it.
4. To review the official policy of the Central and State governments (Kerala) in line with sustainable agriculture.

1.13 Relevance and Importance of the Study

The major form of capital in the surveyed area is land, which is a gift of nature. Its value for farming purpose depends on its quality/fertility. Ironically, the quality of land cannot be allowed to depreciate. Modern farming practices make use of chemical fertilisers
and pesticides increasingly. Also, the weed clearing practice of using spades after the end of the monsoon period and before the beginning of monsoon period in the survey area leads to soil erosion. The purpose of this study is to identify sustainable agricultural practices, which year by year increases land fertility, or which at least leaves fertility level stable.

The study area is a hill district of Kerala state. Hill area has its own peculiar features and specificities. Agricultural practices need to be evolved and developed to suit these features. Due attention must be given to hill specificities such as agro-ecological or climatic zones, inaccessibility, fragility, marginality, diversity, heterogeneity, niche and the human adaptation mechanisms. This study focuses its attention on identifying and elaborating the merits and demerits of those practices in the survey area. It also looks at various dimensions of un-sustainability of Hill Agriculture on smallholder lands in the survey area. Due attention must be given to hill specificities such as agro-ecological or climatic zones, inaccessibility, fragility, marginality, diversity, heterogeneity, niche and the human adaptation mechanisms while adopting any policy of agriculture in the Idukki District. It indirectly examines the issues of poverty and social tensions faced by the smallholder farmers in the Idukki district.
Chapter 1 Introduction

An ideal system of agricultural practices maintains farm productivity for longer periods. This in turn ensures (together with stable prices) regular incomes to farmers. In this way, farm productivity has a bearing on the living standards of farmers. Productivity deterioration may end up in abject poverty of the masses; not only of farmers but also the whole population. This study has particular relevance in the event of reporting farmer’s suicides from hillside districts of Kerala state due to productivity fall and price crash of major agriculture products.

1.14 Hypotheses

This study adopts the major hypothesis that ‘present agricultural practices are sustainable’.

\[ Y = f \left( D_1, X_1, X_2, X_3 \right) \]

\( Y = \) Productivity of output per acre

\( D_1 = \) a dummy variable which indicates whether a particular farmland is prone to soil erosion or not

\( X_1 = \) Total quantity of fertilisers applied

\( X_2 = \) Percentage of the quantity of inorganic fertilisers to the total quantity of fertilisers applied.

\( X_3 = \) Number of plants of the major crop as a per cent of the total number of plants including minor crops
Given the above variables we define the linear regression model and its parameters as follows.

\[ Y_i = \beta_0 + \beta_1 D_i + \beta_2 X_{i1} + \beta_3 X_{i2} + \beta_4 X_{i3} \]

\[ \beta_0 \text{ and } \beta_1 \text{ are differential intercept coefficients of the dummy variable, } D. \]

\[ \beta_1 = \frac{\partial Y}{\partial D_i} \]

\[ \beta_2 = \frac{\partial Y}{\partial X_{i1}} \]

\[ \beta_3 = \frac{\partial Y}{\partial X_{i2}} \]

\[ \beta_4 = \frac{\partial Y}{\partial X_{i3}} \]

Sustainability requires that at least:

1. Soil erosion does not affect long-run productivity.
2. Total quantity of fertiliser application does not affect productivity in the long-run.
3. The Intensity of Inorganic Fertilisation does not affect productivity in the long-run.
4. The Crop Mixing Percentage also does not affect productivity of the major crop in the long-run.

That is \( H_0 : \)
Chapter 1 Introduction

\[ \beta_1 = 0 \]
\[ \beta_2 = 0 \]
\[ \beta_3 = 0 \]
\[ \beta_4 = 0 \]

\[ H_1 : \]
\[ \beta_1 \neq 0 \]
\[ \beta_2 \neq 0 \]
\[ \beta_3 \neq 0 \]
\[ \beta_4 \neq 0 \]

The null hypotheses \( H_0 \) are to be tested based on the primary and secondary data collected. If data do not support the hypotheses, that mean the corresponding partial derivatives is non-zero and the null hypothesis is rejected. The alternative hypothesis implies that the present agricultural practices have significant impact on long-run agricultural productivity in the survey area.

1.15 Area, Coverage and Period of Study

This study is conducted in the ‘high ranges’ of Idukki district in the state of Kerala. This study covers the smallholder farmers who own less than or equal to 5 acres of land and those who grow pepper as the principal crop. The study is conducted during the years 2008 and 2009.
for the period from 1960 to 2009. Primary data have been collected for the entire period over which the sample respondents grow pepper in their small farm-lands.

1.16 CHAPTERISATION

The first chapter of this book deals with a general introduction to this study and research problem. It contains an overview regarding sustainable agriculture in the broad perspective of national and international concepts of overall sustainable development. The views of various writers in the literature of Environmental Economics, policy prescriptions suggested by various International Conferences on sustainable development are reviewed with special reference to the problems and prospectus of agricultural growth in the developing countries.

The second chapter deals with the methodology applied in reaching the conclusions and sample design undertaken for collecting primary data. It also contains a brief description of the various definitions, terms and concepts used in this study.

The third chapter deals with agriculture in the Idukki district. This chapter gives an introduction to the Idukki district, physical features, demography, climate and occupation of the people. This chapter also
Chapter 1 Introduction

examines the problems and prospects of ‘hill agriculture in the Idukki district in view of sustainable agriculture.

The fourth chapter examines the physical features as well as agricultural practices in the Idukki district that affect productivity of farm-lands and data analysis in respect of land productivity.

The fifth chapter deals with the demand for a better environmental quality, among the sample respondents. This chapter estimates the Willingness to Compensate Deterioration (WTCD) for a better quality land which possesses the fertility at an accepted level of fertility in a previous year and establishes the relationship between the WTCD and various factors affecting it. This chapter also discusses the solutions to soil fertility problems.

The sixth chapter deals with sustainable agricultural policy of the Central government in the perspective of organic farming. It also examines how it is implemented in the Idukki district.

The seventh Chapter draws inferences and conclusions based on the analysis done in the previous chapters. It also makes recommendations for improvement.
Works Cited


Chapter 1 Introduction

Tietenberg Tom. *Environmental and Natural Resource Economics.*
