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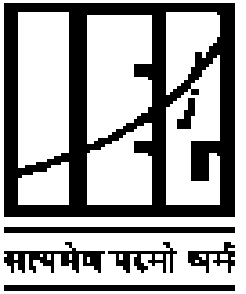

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The growing concern over sustainable development is one of the most important phenomena of the last century. During this period not only did the world community start to explore new paths for future growth, but there has been a fair amount of consensus also over issues of environmental sustainability, which contrasts with the disparate view on the nature and composition of economic growth (Rodrik, 2001). Nevertheless as the search for a new economic order, through the Rio Summit on Environment and Development proceeded, it clearly brought out a divide between the industrialized economies in the North and the primarily agrarian economies in the South. Arguably, sustainable development meant different challenges as well as developmental outcomes in the two sets of economies (Pretty, 1995; Bond, 1996).

Notwithstanding the stark differences in the operating environment between the North and the South, discussions and negotiations on sustainable development at different global forums, including the World Trade Organization (WTO), have remained mainly confined to evolving broad principles, guidelines, declarations and at times, specific resolution (like Agenda 21 of the Rio Summit) rather than addressing the issue of a sustainable production system the world over.[1] This gets reflected in the fact that most of the world forums came up with global targets for environmental sustainability setting up different norms for countries in the North and South.

Given the fact that a large part of economic growth in the North also depends on the resources in the South, unification of environmental management for the `Common Future' (the term coined by the World Commission on Environment and Development) became inevitable.[2] But concern for the global `Common Future' is yet to be translated in to a commonly shared set of goals for development across the North and South. In the absence of this, one finds greater attention being paid, at various international for a, on environmental issues associated with industrial and mining activities, rather than on the issues pertaining to agriculture, food security, and rural development having a significant impact on the livelihood of millions of people in the South.

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1 More recently, the World Summit on Sustainable Development held in 2002 at Johannesburg, reiterated some of the basic commitments and also carried forward the issues of social concerns beyond economic liberalization.

2 Agenda 21, which seeks to achieve sustainable development through international co-operation, provides a framework for sorting out conflicting interests between North and South. The UN, in 1983, set up a commission under Gro Harlem Brundtland. While the commission advocated reduction in consumption of rich in the North, along with development of new technology, growth in production was still considered inevitable.

of the land use is being influenced by this sector (Cooper 2002; OECD, 2001; IIEP, 2002). Ironically, environmental problems in the South emanate mainly from over use of natural resources such as land and water, whereas those in the North emanate mainly because of over use of mechanical and chemical inputs such as machinery, fertilizer and pesticides. While both these may have a serious environmental impact, the developmental implications are likely to be different.

On a generalized plane, it could be argued that people in the South misuse natural resources in order to survive or meet the basic needs**,** whereas environmental damages in the North are caused mainly for sustaining a higher level of growth in production and consumption. Substantively these two are different positions, which could be dealt with by alternative approaches: one of adhering to differential North-South specific norms and obligations as prescribed by the World Trade Organisation (WTO), and the other is to evolve a unified perspective not only on environment but also on development as noted above.[3]

1.2 Environment and Agriculture

Considering environment as a global good, a unified production system, especially for food, may be worked out by addressing the dual objectives of maximizing food production with minimum damage to the environment. Given the broad patterns of natural resource endowment as well as the technology-environment interface for food production in the North and South, this could possibly be achieved by rearranging the world food production system where the North, by and large, specializes in production of water-intensive cereal crops whereas the South may specialize in production of water-saving crops mainly, oil seeds, dry land horticulture and livestock. But, this kind of reorganization of the food production system may not work owing to the fact that Southern countries may not have requisite purchasing power to pay for the cost of food imports at the price at which Northern countries would like to sell. On the other hand, Southern countries have serious reservations about being food-dependent, as it may have adverse political implications.

Another set of constraints emanate from the relative factor endowment in terms of labour and capital. Neither Northern economy have the requisite labour force to be employed for managing extensive farming nor, do countries in the South have adequate capital for enhancing the productive capacities of the depleted land and water resources. Thus, working out an

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[3] This implies considering environment as a `luxury' that developing countries could ill-afford. This perspective, though highly debated, has led to an active debate on adopting differential environmental standards across the developed and the developing countries in the context of trade liberalization. The issue has been discussed at a later stage.

the world over. Nevertheless, it does indicate possible directions by which a unified system of food production could be explored.[4] It is however, pertinent that attempts to explore avenues for sustainable agriculture must have a bearing on the contemporary debate regarding the role that trade liberalization could play in enhancing sustainable development for all.

Given this backdrop, the present paper seeks to examine the status of the interface between agriculture and environment under different resource as well as policy scenarios in a comparative North-South frame work, focusing on the two major food producing economies viz; the European Union (EU) and India, respectively.[5] The analysis is based on two basic premises: First, in so far as agriculture is concerned, the divide between domestic and international trade policies is out of place. The later, especially in the context of a large agrarian economy like India, should form an integral part of the policies for promoting agriculture growth, which is employment generating, spatially broad based, economically efficient and environmentally sustainable. The second premise refers to the fact that policies for promoting agriculture production in the North have a significant bearing on agricultural growth and thereby natural resource use in the South. The trade framework therefore, should address issues of natural resource sustainability on the one hand, and the livelihood of people depending on agriculture (as main user of natural resources) on the other. It is hoped that the analysis may help the exploring policy options for promoting sustainable agriculture in the context of the recent developments in trade liberalization and WTO-negotiations.

1.3 Objectives and Coverage

The specific objectives of the study are to:

(i) Compare patterns of agricultural production, input-use, and major environmental impact thereof in the light of natural resource endowments obtaining in India and the EU;

(ii) Examine the policies for promoting agricultural production, especially in the wake of the new challenges from trade liberalization; and

(iii) Draw policy implications for trade negotiations in a North-South context.

The analysis is based mainly on the existing literature and secondary data. Given the limitations of availability as well as comparability of the data across India and EU, the analysis has been

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[4] For details see, Shah and Weis, 2004.

[5] It may be noted that India does not share similar concerns with other major agricultural economies in South such as Brazil, which tends to seek major opportunity for export growth in the international market.

II. Resource Endowment and Agriculture in India and Europe: A Comparative Profile

This section presents basic profiles of the natural as well as human resource endowment and the recent trends in agricultural sector in the two sets of economies. The data pertain to the later part of nineties or early part of 2000, depending on the latest year for which estimates are available for India and the EU. The idea is to get a comparative picture of the operating environment within which agricultural growth has taken place in the reference economies viz, India and the EU (with special reference to France). However, it would be useful to proceed this by a discussion on the concept of sustainability with respect to agriculture, since the issue of definition continues to surface.

2.1 Sustainability of Agriculture: Some Conceptual Issues

The concept of sustainability, ever since it was propagated by the Brundtland Commission in 1987, has been under debate and is in a process of evolution. The basic criticism frequently is that the concept is too fluid to be defined. According to Pretty (1995), it is essential to identify: What is to be sustained? Till how long? And, for whom?

Notwithstanding the debate, efforts have been made to define the sustainability of agriculture especially in the light of the contemporary discourse on growth (and trade), environmental damages, and livelihood (poverty reduction). For instance, OECD (2001) has defined sustainable development as a 'dynamic process, which focuses on the ability of an economy to improve human welfare in cost-effective ways through developing, combining and substituting resources in the production process. It is also a global concept, which recognizes that allowing flows of resources between sectors and economies through international trade can maximize production while reducing the pressure on fragile resources. What is also important is that the concept is multidimensional, encompassing economic, environmental and social aspects that could apply to a large extent, to the specific activities in agricultural sector' (OECD, 2001; p.8).

A more simple definition, in the context of agriculture, would focus on the sustainability of production over an extended scale of time and space. This essentially would mean that crop production and economic gains would flourish over a long period of time, almost infinitely and globally (vanLoon, et al. 2004; p. 9). While this is a fairly workable definition, it is nevertheless, difficult to translate in terms of policies and actions at a global level. For the purpose of this analysis, sustainable agriculture would refer to a spectrum of the production system, which has a relatively moderate use of chemical inputs as compared to that associated with maximum yield, given the seed variety and the state of the agronomic practices adopted by a large number of farmers. To a large extent, this may imply Low External Input Agriculture (LEIA), which offers

agriculture where ensuring self-sufficiency in food production and employment for livelihood security are the critical functions.[6] Conversely, the most important environmental challenge faced by the member countries of EU, could be considered as overuse of chemical inputs and the related air as well as water pollution. Against this, a critical function of the agricultural sector, especially in less populated and relatively richer countries is to maintain rural landscapes and to keep up the pace of agri-business especially for the export market (EU; 2001).

Keeping this as a broad perspective, it is proposed that any shift in the direction of attaining these two vital aspects, namely; (i) environmental challenges, and (ii) critical functions could be simultaneously treated as a move towards `sustainable agriculture' in each set of countries. This should be treated as reasonable given the context of the present study because the purpose is not to measure `sustainability' *per se*. Rather the objectives of the study, as noted earlier, are to understand policy on environment and the processes that help in promoting sustainable agriculture in India and the EU.

2.2 Resource -Endowment and Agriculture: A Comparative Profile

It may be mentioned at the out set that preparing a profile of resources, input use and agricultural production for India and the EU is a somewhat difficult exercise due to the non-availability of comparable data. The difficulty is faced particularly in the case of information on activities other than crop production. For instance, the data system for the EU provides information on farms with livestock; such information is not available for India. The same is true an estimates on manure application in the case of India. Similarly, information on area under irrigation is likely to be non-comparable because a large proportion of India's irrigation is through ground water resources, the dependability of which is highly questionable. Notwithstanding these limitations, we have tried to compile information on some of the important variables, available from the official sources. Table 1 presents a brief profile of the two economies using published data for India and the EU.

The comparative picture depicted in Table 1 highlights some important differences discussed as follows:

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[6] This is basically borne out of the recent policy document on agriculture in India, suggesting that: `Technology packages already available for dry land and rain fed agriculture will have to be fine tuned to suit the diverse local conditions to impart stability and increase productivity of the cropping systems. A farming system approach will be adopted. Choice of technology will be be carefully identified with a view to maximizing employment opportunities' Draft Policy, 1991].

3. The average land holding size is 1.41 ha. in India as against 18.4 ha. in the EU.

4. Irrigation facility differs significantly with 40.5 % of the net sown area in the case of India as against 15.4 % in the EU. The estimates may not be comparable as the access to irrigation may vary significantly in terms of quantity as well as dependability.

5. Use of NPK is more than double in the EU (approx. 203 kgs./ha) as compared to India (95 kgs./ha). The difference in the rate of fertilizer application may be low when we consider only the area that receives fertilizer application.

6. Of the total cropped area, 65 % is under food crops in India as against 48 % in the case of the EU. If we consider area under permanent crops along with arable area, the proportion works out to be 42 % in the EU.

7. The total quantum of pesticide-use is almost double in the EU as compared to India.

8. Given the relatively higher use of NPK per ha of land, the crop yield in the EU is significantly higher as compared to India. EU produces about 202 million tones of cereals by using only 37,040 thousand ha. of land, whereas India produces 212 million tones of cereals on 123,104 thousand ha. of land. As a result, the ratio of NPK use per kg. of food production (worked out on the basis of the proportion of area under these crops in the case of EU) is 0.54 kgs. and 0.36 kgs. in India and EU, respectively. This suggests a more resource efficient production of cereals in the EU as compared to that in India. The problem however, still remains with respect to higher use of pesticides and also a higher nitrogen balance of the livestock sector in the EU as discussed subsequently**.**

9. Per capita cereal production is 200 kg. per year in India as compared to 500 kg. in the EU. Value of agricultural output per ha is Rs. 21.4 in India as compared to Rs. 37.5 in the case of the EU.

10. Unlike cereal output, India has a relatively higher productivity in oilseed as compared to the EU. Also, oilseeds in India are produced with a much less application of irrigation water and chemical fertilizer.

11. The relative price of rice (in Re. terms) is in the ratio of 1:5 between India and the EU. Indian farmers are paying only 2.75 times lower price for purchasing chemical fertilizer, which suggests that fertilizer is over priced in India as compared to the EU. The need therefore is to improve the productivity of NPK in Indian agriculture, for which water/soil moisture is the main constraint.

subsidies constituted 40 % of the GDP from agriculture, which amounts to nearly 80% of India's GDP (Gulati and Narayana, 2003, 21, 43]. Prima facie this may imply an over exploitation of natural resources due to a lack of adequate investment in the case of India, and over use of external inputs in the case of the EU. This kind of imbalance in policy support may have significant implications for the future growth of agriculture, and in turn, on trade and environment as we will discuss subsequently.

The above observations, based on the limited availability of data, indicate certain important gaps that need to be addressed for a meaningful comparison, especially in the case of a global trade-environment-livelihood interface. It is therefore, important to highlight these data gaps for they have a significant bearing on how `comparative advantage', competitiveness, and environmental as well as livelihood aspects are being viewed in the contemporary discourse. The important gaps are as follows:

First, assessment of competitiveness is generally based on market prices adjusted for purchasing power parity in the two countries. This obviously does not take care of the incidence of subsidies direct or indirect implicit in the price. Given the fact that subsidy levels vary significantly and that comparable information are difficult to obtain for gauging the actual amount of subsidy even for potentially tradable products in the two sets of economies, price-based assessment may often be misleading in the case of farm products.

The second issue pertains to gauging the relative environmental implication of different products and commodities. While it is essential to work out the per unit use of chemical inputs in order to understand the comparative advantage for different crops/commodities in trade, the estimates are difficult to make due to non-availability of crop-specific data especially in the Indian context. What is also important is to evaluate the resultant damages in terms of resource depletion and future yield.

This leads to a third issue related to the regional specificity of crops, governed mainly by agro-climatic conditions. If a particular crop is found to have competitive advantage (vis-a-vis another country) as against another crop grown in the reference country, production of the former may be increased at the cost of the latter in the reference country. But, this kind of substitutability is often not possible since the first crop, possesses a competitive advantage in the external market, may not be (agronomically) possible to grow in the area, which has been growing a crop having a relative dis-advantage in the global market. It is therefore essential to know the extent of substitutability of crops across different agro-ecological conditions. Moreover, the appropriateness of a shift in cropping pattern should be assessed in the light of the impact of trade on the environment, the cost of additional investment, and of employment.

regions in particular. Filling this critical data gap is thus is crucial for future research on the agricultural trade-environment-livelihood interface. In fact, it would be unfortunate if the composition of agricultural production in predominantly agrarian economies like India is changed because the right information is not available!

It is thus, aptly noted in the context of the interface between trade, growth, and environment that: the central issue is not concerned with technology (its aptness or over use), or institutional factors, but with the goals of maximizing the output of a single product (or a few products), as against the maximization of output of a resource system as well as the weights attached to short run as against long run' (Ramachandran, 1990, p.19). The current discourse on trade and environment needs to be tested on this ground.

Given this caveat we may now move on to a review of the existing evidence on environmental impact and the policy framework for the agriculture sector in India and the EU in the following sections.

III. Agriculture and Environment in India: Evidence and Issues

This section tries to review the existing evidence on the environmental impact of agricultural production in India. Unfortunately little is available in terms of environmental impact assessment for Indian agriculture except that there are some official statistics on the degradation of forest as well as land, the depletion of ground water table besides, information air and water pollution caused by multiple sources including agricultural operations.

Prima facie, the relative neglect of this environmental impact assessment of India's agricultural sector a manifestation of the general apathy towards the issue and, also the perception that agriculture, as yet, is not a major contributor to environmental pollution/damages in the country. This kind of perception is often reflected in environmental policies and also in discussions at the various forums nationally as well as regionally. For instance, the strategy identified by the Ministry of Environment and Forest for meeting the objectives of the Tenth Five Year Plan, has a special thrust on promoting sustainable development. This is to be achieved by emphasizing the intrinsic linkage between environment management and socio-economic development through *increased access* to natural resources On a further note, the strategy mentions that `while striving for the goal of increasing forest cover to 25 per cent by 2007, thrust will be given to increasing productivity and efficient management of resources besides other aspects (Khurana, 2003)

These kinds of policy statements reinstate the importance of resource access and utilization for enhancing productivity in the sector. Thus growth in production continues to be the main thrust

due to faulty use of natural resources as well as bio-chemical inputs like seed, fertilizer, pesticide. *Prima facie*, there can not be any denial of the fact that use of external inputs like irrigation–fertilizer–pesticides would bring negative externalities in terms of soil degradation, water logging, depletion of micro nutrients and soil structure, and contamination of ground water, etc. The pertinent issue however, is to draw the line of maximum tolerance level whereby (a) damages do not cross a limit of being irreversible; and (b) decline in land productivity does not become perpetual. How does the food-production scenario in India perform *vis-à-vis* these checks? This has been examined with the help of the limited information available on land degradation and the link between soil quality and productivity (Reddy and Bhagirath, 2000).

(a) Degradation of Land

Table 2 gives state-wise information on the status of land degradation in India. It is observed that land degradation is more or less a universal phenomenon spread across all the states and that, it is not particularly associated with a higher level of irrigation, fertilizer use or crop-yield. Thus, the proportion of degraded land is higher in the semi-arid regions like Rajasthan, Gujarat, Karnataka and Maharashtra *vis-à-vis* states like Punjab, U.P., A.P. and Tamil Nadu where the Green Revolution technology has been wide spread from an early stage. Haryana, of course, is a major exception with 63 per cent of its cultivable land being subject to degradation.

The problem of water logging in the latter, of course, is more obvious *vis-à-vis* the continuous process of degradation, which obtains in the large tracts of low rainfall and/or dry land regions in the country. For instance, while the `Punjab-crisis' is a very acute and strategically more serious problem, it overlooks the fact that a large number of subsistence-farmers with rain fed agriculture, have been sub-optimally utilizing their lands over a longer period of time. Hence a substantial part of the recent increase in fallow land (i.e. during the post eighties) is likely to include some of the major dry land regions like Gujarat, Maharashtra and Rajasthan. This, as noted by Sharma (1997) might have happened because 'the small and marginal farmers who opt out of cultivation for a variety of reasons particularly, due to non-viability of farming on the small and degraded holdings, have resorted to the practice of keeping their land fallow'.

It is thus, erroneous to assume that use of external inputs will necessarily result into higher land degradation *vis-à-vis* subsistence farming, which is often characterized by low irrigation, limited farm yard manure (FYM), inadequate measures for soil moisture conservation, and low adoption of some of the agronomic practices owing to a financial resource crunch. Consequently, a large part of the rain-fed areas in the country continue to suffer from acute soil erosion due to poor vegetative cover, continued extension of cultivation on marginal lands and low content of organic matter (Marothia, 1997; p.480).

technologies, which would not only prevent any further degradation but also help in revitalizing land and water resources for their long-term sustainable use (Sidhu and Dhillon, 1997).

At the macro level, evidence suggest that about one-fourth of the total cultivable area under all the canal projects suffers from water logging and soil salinity (Dhawan, 1997) though the severity of the problem may vary largely across regions. Apart from soil topography conditions, variations in the incidence of water logging may also be attributed to the varying degrees of management efficiencies across systems and the institutional framework within which price and non-price factors influence the water use efficiency.

(b) Depletion of Ground water

The situation with respect to ground water is also quite dismal particularly in the early GR states like Haryana, Punjab and Tamil Nadu (Table 3). Of course, the official estimates presented in Table 3 do not portray the actual gravity of the situation. This is particularly true in the case of some dry land regions where overcoming the damages might take a fairly long time due to unfavourable rainfall as well as soil conditions. In this context, it may be noted that since half the crop acreage that presently benefits from irrigation is based on ground water resources, any set back in the availability of ground water can have serious implications for sustaining the growth of yield in agriculture (Dhawan, 1997).

Of course, water economising devices like drip and sprinkler irrigation offer a lot of scope for sustainable use of ground water. However, their viability for cultivation of food grains is yet to be established on a larger scale. Thus, despite this grave situation with respect to degradation in land and water resources in the early GR regions, the evidence, till at least the early nineties, suggested that 'yield of wheat and rice have maintained an upward trend in Punjab and Haryana even at a high level. However, there has been stagnation in Bihar even at a low level' of degradation (Chand and Haque, 1997: p. A-27). This does not, mean that the total factor productivity (TFP) has kept up the same momentum as that observed in the early phase of the Green Revolution (Kumar and Joshi, 1998). According to the recent evidence, there has been a sharp decline in the TFP of rice and wheat in the Indo-Gangetic Regions. Similarly, studies by Singh (2004) and Kamra and Abraham (2004) highlight two important features of agricultural production in Punjab. These are: stagnancy in crop and rapidly declining economic returns from crop yield in the Punjab. The main causes for the decline are mono-cropping, water logging and imbalanced use of fertilizer (also, see Ghuman, 2001). The studies however, do not provide any quantitative assessment of the cost of environmental damages.

(c) Imbalanced Use of Chemical Fertilizer

concentrated in the two major crops namely; rice and wheat. Together they constitute nearly two third of the total NPK use in the country. Similarly, the use is concentrated in states like Punjab, Haryana, Andhra Pradesh and Tamil Nadu, where the rate of NPK use has already gone beyond 100 kgs. per hectare (See Table 4). An important implication of the observed pattern is that, the negative impact on environment is likely to be highly localized hence, highly intensive, rather than wide spread, notwithstanding the leaching of nitrate in water covering a larger area.

This raises the issue of improving nutrient management on large tracts of land that are both hungry (in terms of fertilizer use both-organic and inorganic) as well as thirsty (in terms of both-soil moisture and irrigation). Observations from a study on the use of organic manure in seven villages of the semi-arid regions in Andhra Pradesh and Maharashtra are quite revealing. It was observed that '40 to 56 per cent of the sample farmers were not using any manure in as many as five (out of nine) years'. Further it was noted 'manure was applied to only about one-tenth of the plots (i.e.15 per cent of the area) every year.... The periodic discontinuation of manure use by many farmers and the pattern of its use probably reflects a severe scarcity of manure and competing alternative uses of organic waste, especially as domestic fuel' (Desai and Rastogi, 1995, pp.184-185).

Fortunately, the shortage of fuel wood in the seventies seems to have evoked a positive response from the farmers in terms of wide spread development of farm forestry and social forest, which in turn, got reflected as relative stability in the prices of fuel wood during 1985-90 (Natarajan, 1995). While it is difficult to assess the extent to which these developments might have eased the constraints on availability of farmyard manure, the scarcity syndrome seems to be continuing in large parts of the semi-arid regions. What is more likely is that the poor farmers, operating marginal lands, may be facing greater constraints of manure as many of them have very limited livestock and also limited purchasing power. Breaking this barrier therefore, is a real challenge for sustaining and accelerating the yield-growth of the traditional varieties grown under rain fed conditions.[7]

Since fertilizer use in India is still at moderate levels as compared to China as well as many of the South Asian countries, the problem is not so much of its over use and the resultant adverse impact on ground water (Marothia, 1997). Rather, the problem in many parts of the dry land regions is of low, imbalanced and inefficient application of chemical fertilizers. It is therefore reasonable to argue that the poor farmers cannot be made to wait till the chronic scarcity of manure is resolved. The moderate application of fertilizer is therefore, necessary if the productivity of the degraded land is to be improved and, diversification from food grain production is to be halted in the dry land regions.

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[7] The Environment Action Programme (EAP) set up in 1993 by the Government of India, has identified seven environmental priorities; of these only one has a direct link with agriculture. This refers to afforestation, wastelands development, soil-moisture conservation, and water pollution (Khurana, 2003).

saved by increasing the pesticide use (CSE, 1985).

Another issue that surfaces here is regarding the types of pesticides used. It may be noted that about half of the pesticides registered with the Indian Pesticides Registration Committee are banned in western countries such as the US. Of course, this does not mean that all the banned products have the same effect on Indian soils as seen in the US. However, India accounts for one third of the cases filed with WTO on pesticide poisoning. The worst sufferers are of course the workers engaged in spraying these chemicals.

Against these evidences, the views expressed by another set of researchers, at least till recently, indicate that 'if compared internationally, the use of pesticides in Indian agriculture is neither extensive nor indiscriminate' (Chand and Birthal, 1997; p.497). Moreover, its use is particularly more widespread in the case of cotton and some of the exported crops like fruits and vegetables rather than in food grains.

Notwithstanding contrary views, evidence suggests the need for proper planning in order to promote and regulate pesticides use in the country. This finding has been supported by the fact that the farmers have only limited awareness of the hazardous effects of pesticides and at the same time have little information on the environment-friendly alternatives (Gandhi and Patel, 1997). In the absence of adequate information as well as the legal framework for fixing up the liabilities of the environmental (health) damages caused by pesticide use, there is little incentive for reducing the rate of application. In turn, this highlights the urgency for regulating its use in a more planned as well as informed manner, possibly by increasing the cost of non-compliance (Marothia, 1997). People's awareness and local institutions can be of immense help in operationalizing the requisite checks and punitive action as it happens in large parts of the industrially-developed economies.

3.2 Cost of Environmental Damages

What is the likely economic cost of environmental damage due to inappropriate use of fertilizer, pesticides and irrigation? There is of course no systematic study on this aspect till now[8]. Nevertheless, a few attempts have been made to gauge the cost of environmental damage in location-specific contexts. For instance, Tisdell, in a study of three villages in Midnapore district in West Bengal revealed that the villagers would require about a 50 per cent increase in the current income in order to compensate them for the loss of natural resources and environmental deterioration (1996; p.18). The problem with these kind of estimates is that they are based on a very small sample in a specific context, and that, the methodologies adopted are often subjective

[8] Recently, CSO seems to have commissioned a study on environmental impact assessment. The study is still in the initial stages.

examines the implications of a projected growth of 4 per cent for the agriculture sector on investment priorities, effective demand, and environment (Table 6). The study finds that the future growth of agriculture is likely to be induced mainly by irrigation; impact of fertilizer subsidy (at 30%) and increase in agricultural prices (by 20 %) may have only limited impact on promoting growth. The projections derived from the model indicated that attaining a 4 per cent growth rate will involve increase in the net sown area from 142.7 to 143.8 million hectare along with a corresponding increase in gross irrigated area from 68.4 to 109.6 million hectare; as also a rise in the consumption of nitrogenous fertilizer from 7.2 to 14.2 million tonnes, which works out to 40.2 and 68.7 kgs. per gross cropped area, respectively (Parikh, 1991, Table 6).

The projected increase in the use of irrigation and chemical fertilizer may have a significant bearing on the state of environment in future. The dominant perspective, as it obtains among a large number of academicians and policy makers in the country, is that the problem of water logging or chemical pollution is largely due to an inappropriate application of these inputs (Parikh, 1991). The policy imperative therefore, is to promote efficient use rather than a blanket reduction in the use of external inputs. With respect to irrigation, which is the major driving force for the growth, the study notes that the `main environmental problems from irrigation are related to the use of water rather than by the processes of creating irrigation facilities. A similar view has been expressed by a number of scholars (Rao, 1994; Dhaliwal and Kansal, 1994; Deshpande and Ramakrishna,1990).

Overall, the existing evidence on environmental impact suggests a relatively lower incidence of damages in a developing economy like India as compared to the developed economies (Table 6). The thrust therefore is to adopt a policy approach, which is preventive rather than restrictive in terms of promoting productivity for the future growth of the agriculture sector in India.

Experts from a study by Rao (1994) summarise the contemporary perspective on the agriculture-environment interface in India. According to Rao, `Of the two major sources of degradation namely, deforestation and chemicalisation of agriculture, the former constitutes a much greater threat at the present stage of agricultural development in India. A high rate of deforestation has been associated with low irrigation, low level of agricultural income, low wage rate, and high incidence of rural poverty. It is much less associated with high population growth and a greater increase in number of livestock. The package of measures most likely to reduce pressure on the environment is the development of land augmenting technological change with an environmentally sound irrigation base, particularly in the low productivity region with extensive poverty' (*Ibid*, pp.249-250).

3.3 Food Security by Regenerating Land and Water in Rain fed/Dry land Areas

on linking up environmental regeneration with employment and thereby provide livelihood security, the focus of many of the local initiatives is to promote food grains production on the degraded lands under private as well as public ownership. *Prima facie*, this kind of approach can help overcome some of the basic constraints faced by individual farmers in adopting crops and/or farm operations, which involve a higher use of labour. Moreover, it can also help in augmenting some of the critical inputs like organic manure and limited irrigation which otherwise cannot be obtained individually by poor farmers. Finally, if supported by the state, these regeneration efforts can be channelised for promoting indigenous varieties of food crops, especially coarse cereals and pulses, that are rich in terms of nutrient value as well as bio-diversity.[9]

While stability of yield under rain fed conditions is an important objective, its realization has been difficult. This has been experienced through a large number of watershed programmes, recently being carried out in some of the semi-arid/ dry land regions in India. The available evidence, to a large extent, indicated that watershed programmes have brought in significant yield gains only when there was significant increase in the availability of irrigation (Shah, 1998; Kerr and Kolavalli, 1999). The only major exceptions are the low-lying paddy lands and/or micro area, adjacent to field bunds or water harvesting structures where the improved soil-moisture profile has brought a significant increase in yield. It may however, be noted that most of the evaluation studies capture only a partial impact in the sense that they have been carried out immediately after completion of the project. Obviously, this is subject to uncertainty and, is likely to be at times, non-sustaining.

If the watershed programme is to play a central role towards enhancement of food grain production under semi arid/rainfed conditions, it is essential that most of the land - both cultivated as well as

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9 Promotion of coarse cereals especially in dryland regions therefore, has been viewed as an important strategy for attaining food security among poor households. This is because the poor often operate marginal lands with little use of external inputs. Generally this kind of land can support only subsistence crops like coarse grains. These grains are considered to be more nutritious as well as affordable because they can be consumed without using any cooking oil. Though convincing, the strategy is difficult to operationalize due to certain inherent difficulties.

Promotion of coarse cereals thus, remains a complex issue till a major break through in terms of development of drought resistant varieties is achieved. This is because the past experiences in promoting HYVs of jowar, bajri and maize under rain fed conditions are not so encouraging since these new cultivars remain highly vulnerable to the weather induced fluctuations. What is of greater concerning is the significant variations in yield of ragi, barley and small millets, where spread of HYVs is fairly limited as shown in Table 8. It would perhaps be interesting to observe to what extent 'natural farming' or 'low input use on resource poor farms can help in reducing these fluctuations in yield? This issue has been examined in the light of selective evidence from watershed development projects in some of the dry land regions in India.

Ensuring higher levels of yields among these crops, *inter alia*, would mean widespread adoption of HYVs or improved seed varieties. For, even in the case of coarse cereals, like ragi and barley, the potential yields are more than double that of the traditional varieties (Desai and Namboodiri, 1997). What is pertinent is that these kinds of yields are seldom realized in the absence of at least 'limited irrigation', which thus, becomes critical for attaining both food security as well as environmental sustainability.

Alternatively, one may review the experiences of promoting traditional varieties under zero or low external input farming systems. A recent study on a comparative performance of the traditional *vis-à-vis* HYV of wheat under unirrigated conditions suggest that the yield level in the former may range from 1150 to 1688 kgs./ha vis-à-vis 2606 kgs/ha in the case of HYVs. In the case of potential yield, the range is between 2000–2400 kgs *vis-à-vis* 3600 Kgs/hectare for the HYV (Nellithanam, 1997). The important aspect in this comparison however, is the difference in the cost, which is significantly lower i.e. Rs.3500 vis-à-vis Rs.6200 per hectare in the case of HYVs. This would imply better sustainability of the former economically as well as environmentally.

Overall therefore, it appears that while these experiments provide fairly encouraging results, their expansion on a wider scale might require further research and development. As of now, the general view, which is generally shared among academicians, is that this kind of experiments in natural farming is less productive and less profitable as compared to the use of conventional technologies (Vyas and Reddy, 1998).

The policy statement on Agriculture (2001) thus**,** lays special emphasis on blending the twin goals of enhancing productivity with minimum environmental damage, given the crops and state of the technology.. This would involve simultaneous efforts in the direction of: (a) realization of the full yield potential of the existing crop-technology mix by adopting a farming systems approach with inbuilt diversity; and (b) increasing the agronomic potential by undoing the damages in terms of degradation of land and water resources.

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[10]. At present, watershed programmes, especially, in the semi-arid regions, have adopted two rather extreme approaches of concentrating either on first water harvesting structures and thereby promoting irrigation intensive crops. Or, second these resort mainly to *in-situ* conservation of rainwater without significantly increasing irrigation facilities for a large number of farms and households. As a result, one often observes that increased availability of irrigation is used intensively by a smaller number of farms and households. This apparently, results in favourable benefit-cost ratios despite the fact that the remaining land continues with low productivity and scanty vegetative cover (Shah, 2000). Moreover, with increased irrigation on a selective area under cultivation, there is always a tendency to shift towards more water-intensive crops like cotton, spices or vegetables. This kind of selective benefit however, may neither be conducive for stabilizing yields nor be effective for regeneration of land.

more conducive as it will necessitate an initial investment in checking water logging and flooding in the high potential rain fed areas on the one hand, and improving soil- moisture conservation in the low potential dry land regions on the other.

3.4 Emerging Policy Issues

This brief account of environmental impact of agricultural sector in India while being inadequate, however suggests that the damages are severe but not irreversible in most cases except for selected areas of water logging and ground water depletion. What is also important is that a large part of the damage has occurred because of the wrong price signals for both - input and output, rather than the wrong choice of crops/technology. If this is true, the next phase of agricultural growth could be achieved by a relatively moderate shift (on the lines of LEIA) in crop mix, input use, and agronomic practices especially in large tracts of dry land agriculture in the country. It may however, be noted that achieving even the moderate shift may require substantial changes in the way agriculture is being practiced in some of the marginalized areas like dry land, forest and hilly, and coastal in all facing severe depletion of natural resources.

Managing even a moderate shift may therefore, involve a huge task in terms of mobilizing resources for investment in agriculturally laggard areas, modifying the property rights regime as well as the requite institutional structures, and altering the input-price structure in a manner that compels farmers especially, with irrigation facilities, to improve water use efficiency. All these, primarily need a strong political commitment and will. The multilateral institutions for trade negotiations may also play a role in facilitating a policy shift such as this.

(a) Environmental Governance

At present there are a number of regulations influencing the use as well as management of natural resources[11]among which two are specially important in this context. The first relates to

[11] Of these, there are a few that directly deal with resource use in agriculture. It may however be noted that India does not have an official policy statement for agriculture since it forms a part of the joint list of sectors to be dealt with by the state as well as the central government. Environment on the other hand is a central subject, hence most of the environmental regulations are independent of the sectoral targets for agriculture. Of course, the environmental regulations and/or strategy are formulated by incorporating the overall targets for growth and development, put forward by the plan documents and the other policy documents as we had noted above. In case there are conflicts and/or overlaps between the state agricultural policy and the environmental regulations of the central G\government, the later prevails upon the former. It is therefore, essential to look into the various environmental regulations that have direct bearing on the resource use in agriculture (Khurana, 2003; p.4).

While the regulations related to land use are by and large governed by the concerns of equity and diversity, that for water use are mainly borne out concerns for `sustainability' of resource in the long run. Notwithstanding the validity of the underlying rationale, and also the administrative mechanism for ensuring an effective implementation of these regulations, the actual compliance especially in the case of ground water is found to be abysmally weak. This is due to the fact that ground water, in most cases, is controlled by individuals owning land.

Another important issue relating to weak compliance of environmental regulations pertains to improper use of pesticides especially, on fruits and vegetables, causing problems of health hazards. Certification of seeds and use of genetically modified organisms (GMO) are yet other dimensions that need greater attention from the viewpoint of environmental governance.

Besides this, issues like mono-cropping, over use of water, imbalanced use of chemical fertilizer, declining quantity and quality of farm yard manure, and absence of measures for soil –moisture conservation as well as field drainage, etc. are primarily related to the distorted price and subsidy structure as discussed below.

(b) Prices and Subsidies

Given the fact that India has been a semi-planned economy, regulation of cost and prices have been the most important policy intervention, influencing the agricultural sector. This is so particularly because of the policy commitment for achieving food security by ensuring the requisite level of aggregate production and its availability through the public distribution system (PDS). The link between aggregate production and distribution is established through procurement of selected agricultural commodities especially, wheat and rice. The minimum support price (MSP) programme, is aimed at covering all major crops in the country. However, in practice it focuses on only rice and wheat, and covers selected areas in the states like Punjab, Haryna, western Uttar Pradesh and Andhra Pradesh. The MSP is based on the notion of covering full cost, which made it go beyond the domestic market conditions. Historically, the MSP for wheat and rice were increased at rates below inflation and remained well under import parity prices (Landes and Gulati 2004; p.361**).** Regulation of prices of both-inputs as well as out put thus, has been the core of these mechanisms for ensuring aggregate supply on the one hand, and its actual access among most, if not all, consumers.

Notwithstanding the laudable policy goals, agricultural pricing and subsidies have remained one of the highly contested issues in the country. The main tenor of the debate on output (procurement) prices is that it is a double-edged instrument, which seeks to support both - the producers as well as the consumers. This, indeed, is a very tricky situation since incentives provided to producers fail the objective of supporting the consumers and vice-versa. While this

in agriculture and related activities, increasing agricultural productivity would also increase purchasing power among a large section of the poor. The relevant issue therefore is- how to achieve significant increase in agricultural productivity, and what could be the role of price/subsidy vs. non-price/technological interventions in achieving this goal?

A plethora of literature exists examining the relative importance of price and non-price factors in the Indian context. The literature, to a large extent, indicates that non-price factors especially, technological break-through has been a major driver of agricultural productivity as compared to the role played by price related incentives (Narain, 1965; Chopra, 2004). While the literature does indicate a relatively crucial role of the non-price factors, the question which needs to be addressed is - to what extent, price-support or subsidies are essential for sustaining the increased productivity in agriculture? The next question then would be to know how far these subsidies have resulted in the environmental damages noted earlier.

The existing literature on the impact of price support to Indian agriculture focuses separately on the aspects of input-subsidy and price support for procuring the output. The former, to a large extent, refers to subsidies for fertilizer, irrigation or power, and other inputs like seeds, farm-equipments, credit infrastructure, etc. especially, to small and marginal farmers. Agricultural subsidy especially on irrigation, fertilizer and public distribution of food are the major constituents of the total subsidy (Mehra, et.al. 2003).[14] A brief summary of the extent as well as impact of subsidies in major segment of Indian agriculture has been presented in Appendix I.

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12 This, essentially is different from the situation prevailing in the developed economies such as the EU where subsidies are offered to the farmers primarily for sustaining their interest in production, which is often at a price far exceeding the price at which most of the consumers within the economies could afford to pay. That these economies still need to subsidize the farm products because there is excessive production, which needs to be sold in developing countries, most of whom have the same problem as that in India of limited purchasing power. The issue of competition and maintaining the market share in the world market make it further more complex (OXFAM, 2002).

13 The major limitations of the MSP have been discussed in detail by Lnades and Gulati (2004), who argue that the MSP, of late, has lost connection with both domestic as well as world price. One of the major arguments in the discussion is that the MSP for rice and wheat have led to undue inefficiency, which in turn, hinders the export potential. The situation is further aggravated by inefficiencies in processing and transportation. On the other hand, lack for MSP or other policy support for crops like other cereals and pulses have suppressed their production. Making MSP connected with the domestic as well as world prices therefore may help mitigate some of the inefficiencies- both in terms of cost of production as well as environmental externalities**.**

14 These estimates, based on the basis of domestic supply cost, are likely to be under estimated.

(c) Rationalization of Subsidy and Environmental Concerns

One of the possible ways of redressing the distortions is by way of incorporating environmental considerations into the subsidy structure in a manner, which enhances efficient rather than intensive use of inputs and natural resources such as land and water. Gulati and Narayana (2003) have worked out the total support of the agricultural sector in India (Table 11). It is demonstrated that Indian agriculture is much less subsidized as compared to that in the EU, the estimates suggest that India has deprotected a large number of agriculture commodities. The phenomenon becomes clear when one looks at the alternative estimates using shadow prices (Anand, M., 2000).

Viewed from the policy perspective therefore, India has reached a historical vantage point, from which the country can launch on to a growth path that could simultaneously reinforce resource regeneration, productivity enhancement, and poverty reduction. Ideally, India should be able to move on this path mainly by correcting the domestic distortions in prices and subsidies. If so, she may not need to submit to the externally determined choice of crops, production technology and exports under the current trade negotiations on environment. For arguably, undertaking reforms on one's own terms, may work out better than doing that under duress in the context of WTO-negotiations. In that case, India's present position of resisting environmental restrictions to dampen export possibilities may stand justified, provided the country is seriously embarking upon a modified strategy for agricultural growth as discussed above.[15]

Assuming that the country can muster a political commitment at this point in time, there may still be real problems in mobilizing financial resources within given time frame (of say, 7-10 years), so that the historical opportunity, that we talked about is not lost. The process of trade negotiations may perhaps, help in this context. But the present processes of trade negotiations do not seem to be moving into this direction since the central focus continues to remain on increasing the volume of trade, which in turn is treated as welfare enhancing given the conventional neo-classical framework. This point is very well brought out by Rodrik (2001; p.6), who argued that `the problem with the current trade rules is not that they over emphasize trade and growth at the expense of poverty reduction but that they over emphasize trade at the expense of poverty reduction and growth'. While we do not intend to get into this issue as it deviates from the scope of the paper, it is useful to keep track of the contemporary debate on trade which seeks to question the role of trade itself, in promoting sustainability and human welfare, rather than taking it for granted.

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[15] There are however, other issues like the relative burden of subsidies and the stage of growth at which other countries are trying to adopt environmental restrictions varying in nature as well as extent**.**

The policy approach in the Tenth Five Year Plan has already moved towards greater emphasis on sustainability. Nevertheless, the issues of sustainability is tackled more on a piecemeal basis by undertaking various programmes such as participatory watershed and irrigation management, reclamation of degraded land, afforestation etc. rather than by correcting some of the macro policies for research and extension, prices, and market-institutional development. This is reflected for instance in (a) increasing yield through faster expansion of irrigation and the associated inputs, still remains the key to achieving the growth targets; (b) efforts for enhancing land and water resources, through watershed development, operate more or less in isolation of the yield-augmenting strategy; and (c) despite recognizing the needs of specific agro-climatic regions, the approach is crop-specific rather than oriented towards promoting the farming systems, suitable to different agro-climatic regions.

IV Environmental Impact of Agriculture in EU: Assessment and Policy Initiatives

Increasing concern for environmental quality has been a major feature characterizing policy engagement for agriculture in the North especially, in the EU and other members of the OECD (2001) With growing prosperity and awareness, there has been an increasing recognition of the need to improve the environmental performance of agriculture in the EU. Evidently, the widely held recognition as well as demand for improved environmental performance of the sector has led to a major move towards policy reform, which seek to `encourage farmers to produce the goods that the consumers want rather than those that attract the highest subsidies. And that, they want above all, healthy-good-quality food together with a healthy environment and sustainably managed farm land' (EU, 2002).

In the late nineties, the OECD, of which the EU is an important part had carried out a detailed study on Agriculture and Environment: Issues and Policies. Based on the study, a report was published in 1998, which clearly indicated the need to identify as well as monitor environmental indicators that can directly feed into policy formulation. Thus the EU has moved significantly in terms of generating a statistical system and a database for assessing environmental performance of the agricultural sector within the member countries.[16] This section presents results from the recent report on the EU-countries, with a special focus on France.

4.1 Environmental Indicators for EU's Agriculture

[16] OECD has also set up a data base for environmental indicators for the member countries. See, OECD (2001**).**

- Bio Diversity (farm, animal and plant diversity),
- Wildlife and semi-natural habitats (diversity of animal and plant habitats associated with farming),
- Rural Landscape (environmental features of areas shaped by farming, including those associated with historic buildings and landmarks).

Recently the OECD has prepared detailed assessment of the environmental impact of agriculture among member countries including the EU-15. Some of the major findings have been highlighted as follows:

Land: There has been a decline in agricultural land, converting into forests and open urban-commercial use. Conversion of marginal farm-land is likely to cause soil erosion, reduction in water retention capacity, loss of landscape and wildlife. Between 1985-87 and 1995-97 agricultural land in the EU had declined by 5 per cent; the decline was more than 10 per cent in the case of Italy and Ireland. The shift from crop land to permanent pastures also have significant environmental impact. By the mid nineties, over one third of the EU's agricultural land was under permanent pastures, which is likely to have increased overtime.

Fertilizer Use and Nitrogen Balance: Nitrogen surplus remains above 50kgs/ha on almost 50 per cent of agricultural land in the EU; it exceeds 100kgs./ha on 22 per cent of land and it is in excess of 200kgs./ha on 2 per cent of land under agriculture. Livestock happens to be the major source of nitrogen input in the EU. Table 10 shows the status of the nitrogen and phosphorous emissions into surface water in the EU-countries.

Environmental emissions resulting from agricultural use of nutrients also have an international dimension because of transboundary nutrient emissions into rivers, lake, marine waters and the atmosphere, and their contribution to global warming.

Pesticide Use: As many as 700 pesticide products (active ingredients) are being marketed in the EU. Each of these products poses unique environmental and health risks. The total pesticide use in the EU is estimated to be 253,684 tonnes though the use level has started declining in most of the member countries. A recent study on ground water found a considerable number of sites with pesticide concentration exceeding 0.1 microgram per litre, which is the maximum permissible concentrate in the EU. Another study in France revealed that pesticides are present in excessive quantities in water especially, surface water. Only 3 per cent of the monitoring points did not have pesticide content (OECD, 2001, p.243).

Green House Gases (GHGs): While the emission level of GHGs from agriculture are largely affected by the type and scale of agricultural production, agronomic practices may also exert a

Chart I

Issue	Major Sector
Maintaining extensive pastoral landscapes	Beef, sheep and goats, dairy
Maintaining extensive Southern arable	Arable
Declining marginal farming systems	All above and some 'Southern' crops e.g. wine, olives
Eutrophication of water (and related bio-diversity decline)	Pigs, dairy, beef, horticulture, arable, olives, sugar
Pesticides in water	Horticulture, arable, olives, vines, sugar
Soil erosion	Cereals, maize, oilseeds horticulture, sugar, also sheep and goats
Over-abstraction of water-irrigation	Arable, dairy (maize) olives, horticulture, sugar, wine
Ammonia from indoor livestock	Cattle (dairy and beef), pigs
Greenhouse gas production and potential contribution to climate change	Cattle, pigs (contribution) Grassland, energy crops (mitigation)
Biodiversity/landscape – loss of valuable habitat to intensive agriculture	Arable, dairy, beef, sheep and goats, horticulture, olives, wine, sugar
Biodiversity – decline in farmland species (pesticides, nutrients, field enlargement)	Arable, dairy, intensive 'Southern' crops, sugar
Decline in biodiversity and landscape from neglect of management	Pastoral systems, areas of former mixed farming now wholly arable, traditional olives and vines in Southern member states

The information in Chart I gives a fairly comprehensive idea of the environmental challenges facing agriculture in the EU. Fortunately, the policy response in the EU is fairly good. Not only has there been a significant move towards an environmentally conscious Common Agricultural Policy, but also, the implementation is particularly impressive when it comes to comparing this with the Indian experience. In what follows we highlight some of the important features of the policy reforms and the emerging issues for effective implementation of the change brought about in the CAP.

4. 2 Policy Reforms in the EU: Initiatives and Issues

The main objectives of the Common Agricultural Policy (CAP), formulated way back in 1960 (as a follow up of the treaty of Rome, 1957) were to: guarantee food supplies; increase productivity; ensure a fair standard of living for farmers; stabilize markets; and provide food to

environmentally beneficial activities on their land, against which they get compensated for the cost incurred and the incomes lost.[17]

The main objectives of the Agri-Environment Regulations are twofold: (i) To reduce the negative pressure of farming on environment, in particular on water quality, soil, and bio-diversity; and (ii) to promote farm practices necessary for maintenance of biodiversity and landscape as well as prevent degradation and fire risk from under-use of land. The measures of course, are voluntary for the farmers.

The reforms process that started since 1992 and culminated in the Agenda 2000 in 1997, laid special emphasis on environmental goals. The main aim of the Agenda 2000 was to respond to the challenges facing EU's agricultural sector in the twenty first century. The proposal was to adopt a dual approach while focusing on first, enhancing the competitiveness through specific commodity policies i.e. pillar 1; and second, promoting integrated rural development through modernization of agriculture, creation of new activities and job opportunities for the rural communities i.e. pillar 2.

Besides these environmental measures have been given special attention within the integrated rural development programmes. This involves two sets of measures – the first, refers to those targeted directly at protecting and improving the natural environment, and the second, refers to those that aim at creating new opportunities in rural areas to help preserve the rural landscape. This implies that environmental goals are interwoven with the reforms in terms of Pillars 1 and 2 noted above.

While the above approach for Greening of the CAP is fairly well accepted, subsequently, it has raised a policy dilemma at the time of translating the approach into actual policy measures. The central question raised in the debate is: Whether environmental goals for rural areas can be achieved by adopting explicit agri-environment instruments dealing with Pillar-2 alone or, is it also necessary to reform the commodity-specific measures in Pillar 1, which is patently aimed at ensuring farm income support? Basically, the dilemma indicates the absence of a policy framework, which integrates environmental sustainability in the mainstream processes of growth in production.

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17 The present framework for rural development in EU was first defined in the Agenda 2000, which provided a set of regulations which established norms and procedures for utilization of the financial allocations by the member countries (Reg. 1257/99). Besides these there are two other possible interventions through Structural Funds for lagging areas or those facing structural difficulties; and LEADER PLUS community activities (Saraceno, 2002, p.3).

The debate therefore centres round the issue of balancing the priorities of the two functions of rural development. It has been asserted that the sustainability of rural areas does not depend on the farming sector alone but on the diversity and attractiveness of the resource base in relation to other types of areas - both rural and urban. This essentially argues for an integrated approach for sustainable development going beyond sectoral reforms in agriculture. In turn, this implies that the environmental concerns need to be included both within the sectoral functions (water, soil, production practices) and territorial functions (impact on tourism, industries, energy production and consumption, infrastructure, services etc.) Recognising the need for a holistic approach is important because promoting the sustainability of rural areas involves more pro-active polices rather than compensatory measures as envisaged in the CAP-reforms policies. .

Given this backdrop, the CAP-reform process tries to integrate environmental compliance in a comprehensive manner i.e. in both Pillar 1 and 2. The underlying rationale is that (Sumpsi and Backwell, 2001, p.3): (i) there must be coherence between agricultural and environmental policies; (ii) steps should be taken to ensure that environmental services obtained through pillar 2 are not undermined by the significantly higher (about six times) expenditure on pillar 1; and (iii) introduction of environmental requirements into pillar 1 may help generate wide spread public support.

Moreover, the policy makers seem to be fairly clear about the increasing preference for better quality products and environmental preservation. Seeking people's support thus, would require a set of policy measures that fulfill people's aspirations for better environment and conservation not only for retaining rural life styles but also for the quality of food they consume. This, in turn, has led to a comprehensive framework that links agriculture and environment. The reform process thus, focuses mainly on for instance: (a) decoupling of direct payments; and (b) shifting more resources into agri-environmental schemes and rural development as shown in Chart II.

Chart II: Some Important Features of CAP Adjustment Mechanism

Features	Adjustment Mechanisms				
	Modulation Agenda 2000	Mid Term Review (MTR) Dynamic Modulation	Greening Pillar I	Digressi-vity	Bonds
Decouple the pillar I Direct payments (DPs)	N	Y	Y in part	?	Y

While CAP has moved significantly towards the reforms agenda, the real issues facing policy are: choice of instruments, and the pace at which these instruments may be put into practice. On the issue of integration of environmental concerns in to CAP, the emerging perspective is to link up with the trade-induced policy changes that require a drastic reduction in subsidies. The EU's position so far has been to reduce the subsidy provided that the other partners also do the same. Similarly, it holds that the export subsidy should not be the sole target of subsidy-discipline; export credits, used by other developed countries, should also be made subject to fiscal disciplines promoted by trade negotiations. Given these contours, export subsidies in the EU have been reduced from 25 per cent of the total value of agricultural products in the early nineties to 12 per cent in the initial year of the 2000.

In fact, environmental issues are being seen as useful means by which some of the existing subsidies could be transferred from Pillar I to Pillar II by using the provisions of the Green and Blue boxes. It has been contemplated that a bulk of the existing support to agriculture will be justified on environmental grounds; the need therefore, is to restructure subsidies in a manner that promotes rural development without sacrificing the EU's market share in world trade. The menu of measures available for attaining this shift is wide and varied (Saraceno, 2002, p.4). Of course, very few of these measures are new. What is however, crucial is to find out how to go about implementing these measures under the present mode of voluntarism.

The mid-term review on Agenda 2000 conducted during 2002 thus, has highlighted some important gaps. It has been noted that: 'much has been achieved in the reforms process since 1992. Market balances have been improved and agricultural incomes have developed favourably. A sound basis for enlargement and the current WTO negotiations has been established. Yet, in many areas gaps remain between the objectives set in Agenda 2000 for the CAP, and its capacity to deliver outcomes expected by the society' (EU, 2001, p.9). More specifically, on the environmental issues, the Mid Term Review notes that: `Within the market regime, the scale of support still provided through prices and product specific payments may discourage farmers from more environmentally-conducive production methods'.
In the light of the above discussion it appears that with the rapidly liberalizing trade in agriculture, the onus of `greening of the CAP' ultimately lies on how the trade negotiations engage with non-trade (or non-tariff) issues such as environment and food security.

Meanwhile, the important lesson for India is to understand the policy dynamics in the EU, which seeks to promote sustainable agriculture as an integral part of the CAP. Although the policy in the EU is still striving to resolve the inherent conflicts between the two pillars (dealing with subsidies to sustain growth in production as well as exports on the one hand, and environmental concerns under the multiple objectives of rural development on the other), recognizing the conflict and responding to the popular demand for sustainable production are the two most

Europe. The review has been placed in the specific context of the emerging concerns not only for environmental sustainability but also about food (livelihood) security and quality among people in the two set of countries. The issue is particularly important in the context of increasing liberalization of agricultural trade, which potentially, can shift the locus of environmental damage on the one hand, and influence people's livelihood base on the other. While the analysis does not get into details of the trade-agriculture-environment interface, it is asserted that the issue of sustainability of agricultural production essentially, needs to be viewed in the light of the close linkages between these three aspects since, environment is a global good and the livelihood of the poor ought to be a global concern in a rapidly globalizing world.

Given this backdrop, the analysis tried to prepare a comparative profile of the agricultural sector in India and Europe, which subsequently, was followed by a mapping of the environmental impact and a detailed discussion of the policy dilemma faced by the two sets of countries. It is demonstrated that the production reality between the two differs not only in terms of time lag with respect to stages of economic growth, but also differ substantially in terms of resource endowment - natural as well as human. These differences obviously, will have an important bearing on the pace and approaches followed for promoting sustainable agriculture in the two sets of economies, in which the goal of sustainability assumes prime importance.

Recognizing that sustainable agriculture may potentially help to converge the multiple objectives of resource management, regional balance, and employment generation, it is argued that whereas the need for shifting to sustainable agriculture in India is primarily driven by livelihood concerns and internal market, in Europe it is driven mainly by concerns for quality of life and external pressure. It is in this context, the analysis brought out some important features of agricultural growth and policy perspectives in India and Europe. These are:

(i) Indian agriculture is still at the initial stage of the trajectory to intensive agriculture with half the rate of fertilizer use and a 3.6 times lower use of pesticides per hectare of net cultivated area as compared to such use per hectare of arable area in the EU.

(ii) Nevertheless, the productivity differences are enormous. India uses almost three times the land in EU to produce more or less the same amount of cereals output as the EU. This also reflects the lower productivity of NPK use in India. This is despite the fact that Indian farmers pay a higher effective price for fertilizer as compared to that in the EU. Improving the land and nutrient productivity thus, is a major challenge for Indian farmers.

(iii) Enhancing the access to water and a shift in cropping pattern in favour of lesser water use as well as nutrient intensive crops such as oilseeds, coarse cereals, and pulses may be an important strategy for moving in this direction.

livelihood/lifestyle concerns have to come to the centre stage. Trade may, at best, play a facilitating role rather than an objective by itself. The issue of trade and environment has been currently under active debate among both - academicians and policy makers in the context of the trade negotiations. What is, missing however is the livelihood/lifestyle concern as an integral part of the present discourse on trade and environment.

Net sown area (‘000 hect.)	141,231	76,712	17,809
% of workers in agri.	53	-	31
Average landholding size (hect.)	1.41	18.4	41.7
Agri. output per NSA	21.4	37.5	36.5
Agri. output per capita (Rs.) (EU)	29 -	38 0.75	54 1.09
% of irri. Area to NSA	40.53	15.40	-
NPK use (‘000 tonnes)	17,360	15,610	4178
NPK use per Ha.	95	203	235
Price paid by farmers for urea (Rs.)	8696	24,000	17,440
Yield per Hectare			
Rice Wheat Oilseeds	2090 2770 791	6200 5470 259	6550 6,620 287
Pesticides consumption (tonne)	107,864	253,684	-
Pesticide/NSA (kg/ha.)	0.8	3.3	-
Production			
Cereals (‘000 tonnes) Per capita (kg./persons) Oilseeds	212,034 200 33,624	202,574 500 13670	60,280 1000 5518

Sources: CMIE, Various Issues; Center for Monitoring Indian Economy, Mumbai; and OECD, 2001a.

06	Himachal Pradesh	N.A.	51.6	-	-
07	Karnataka	56.7	66.4	-	-
08	Kerala	43.6	20.9	N.A.	-
09	Madhya Pradesh	56.9	50.1	-	-
10	Maharashtra	55.5	52.6	+	NC
11	Orissa	43.7	58.9	-	+
12	Punjab	26.4	37.6	+	NC
13	Rajasthan	70.1	81.6	+	-
14	Tamil Nadu	41.5	46.9	+	-
15	Uttar Pradesh	32.7	27.6	-	-
16	West Bengal	36.9	32.9	+	-
17	All India	51.8	52.7	-	-

Note: NC = No Change or Insignificant change
Source : Based on Table 2 in K. Chopra, 1996

Table 3: Over-exploitation of Ground Water Among Selected States

States		No. of Blocks having Over Exploitation	Total No. of Blocks	(a) % to (b)
		(a)	(b)	(c)
A.	**BLOCKWISE ASSESSMENT**			
1	Bihar	0	585	0
2	Haryana	45	108	42
3	Karnataka	6	175	3
4	Kerala	0	154	0
5	Madhya Pradesh	0	459	0
6	Punjab	62	118	53
7	Rajasthan	45	236	19
8	Tamil Nadu	54	384	14
9	Uttar Pradesh	19	895	2
	Sub-total	231	3114	7
B.	**OTHERS**			
10	Andhra Pradesh	6	1104	1
11	Gujarat	12	184	7
12	Maharashtra	0	1503	0
	Sub-Total	17	2791	1

Source: Based on Table 3 in B. D. Dhawan, 1997.

Jammu & Kashmir	41.2	46.5	40.0
Karnataka	70.5	76.9	66.4
Kerala	82.5	75.6	66.5
Madhya Pradesh	35.8	35.4	35.3
Maharashtra	67.1	64.4	57.3
Orissa	21.0	21.4	21.9
Punjab	161.9	170.6	162.2
Rajasthan	19.7	23.8	27.4
Tamil Nadu	128.8	142.6	113.6
Uttar Pradesh	88.7	89.0	86.0
West Bengal	90.7	91.6	87.6
All India	69.7	71.1	67.6

Source: Table 4 in G.S. Dhaliwal and B. D. Kansal, 1994.

Table 5: Crop Yield by Irrigation Status

Crops	**States**	**Yield (kgs/ha)**	
		Unirrigated	**Irrigated**
1. Rice	All States	1046	1972
2. Wheat	All States	2177	1133
3. Jowar	Maharashtra	935	598
4. Bajra	Maharashtra	970	559
	Haryana	1009	659
	Gujarat	1075	502
5. Maize	Madhya Pradesh	1497	1237
	Gujarat	1628	1098
	Andhra Pradesh	2800	1687

Source: Ministry of Agriculture, *Area and Production of Principal Crops in India*, Various Issues, Department of Economics and Statistics, New Delhi.

Pollution control	2002	2002	2002	2015	2018	2023
Mining	2009	2012	2015	22016	2017	2021
Bio-electronics	2010	2011	2007	2019	2023	2029

Source: Appendinx 1 in H. Ramachandran, 1990.

Table 7: Proportion of Pesticides Used on Different Crops in India

Crop	Pesticides Used (%)	Cropped Area (%)
Cotton	54	5
Rice	17	24
Vegetables and fruits	13	3
Plantation crops	8	2
Sugarcane	3	2
Oilseeds	2	10
Others (including wheat, coarse cereals, millets and pulses)	3	54

Source: Table 7 in G. S. Dhaliwal and B. D. Kanasal, 1994.

Table 8: Yield among Major Crops – Mean and Variation

Sr. No.	Crops	1984 – 85 to 1994 – 95			1984 - 85	1994 – 95
		Mean Yield	CV	Max. Yield	% Share in Total Production	
01	Rice	1670.00	10.1	1910.0	38.7	42.3
02	Wheat	2194.5	10.0	2560.0	31.0	32.9
03	Jowar	762.7	15.9	980.0	8.0	6.0
04	Maize	1417.3	14.3	1690.0	5.4	5.1
05	Bajra	558.2	27.4	840.0	5.1	3.8
06	Ragi	1166.4	11.3	1380.0	5.4	3.9
07	Small Millets	432.7	9.5	490.0	2.5	1.2
08	Barley	1568.2	13.1	1940.0	1.2	0.8
09	Pulses	557.6	6.4	609.6	8.4	7.2
10	Total Cereals	1497.5	11.8	1759.9	91.6	92.8
11	Total Foodgrains	1325.5	10.7	1550.0	100.0	100.0
12	Total Coarse Cereals	835.9	14.9	1063.0	22.0	17.5

Note: CV = Co-efficient of Variation

Source: Ministry of Agriculture, *Area and Production of Principal Crops in India*, Various Issues, Department of Economics and Statistics, New Delhi.

Agri. investments increased by 50%	2.65	6.28	5.17	0.66	0.69	90.0	14.18
Additional investment in irrigation	3.79	6.77	5.86	0.67	0.57	109.6	14.24

Source: Based on Table 3 in K. Parikh, 1991.

Table 10: Share of Agriculture in Total Emissions of Nitrogen and Phosphorous Into Surface Water among the EU- Countries

% Range	**Nitrogen**	**Phosphorus**
<20	-	U.K., Belgium, Norway
21-30	Finland	Luxembourg, Greece, Switzerland, Sweden, France, Netherlands
31-40	Switzerland, Belgium	Ireland, Italy, Poland, Denmark
41-50	Germany, Norway, Sweden	Germany, Finland
51-60	-	-
61-70	Italy, Poland	-
71-80	France, Netherlands	-

Source: Annex Table 2 in OECD, 2001a; p. 249.

1985-86	13.04	14.22	7.44	34.7	27.7	5.0	1.48	195.7	156.0
1986-87	17.06	0.72	10.78	27.1	20.4	3.6	1.04	153.3	115.5
1987-88	25.35	5.27	19.72	50.3	35.1	6.0	1.71	294.8	205.3
1988-89	30.07	18.97	23.54	72.6	47.0	7.0	2.06	398.2	258.1
1989-90	35.94	28.58	23.09	87.6	52.9	7.6	2.14	480.7	290.1
1990-91	46.21	45.58	25.71	117.5	64.3	8.7	2.46	632.7	346.3
1991-92	58.84	35.07	28.68	122.6	59.0	7.7	2.22	672.7	323.7
1992-93	73.44	32.61	32.88	138.9	60.7	7.8	2.20	749.0	327.5
1993-94	89.57	33.52	34.41	157.5	63.6	7.1	2.02	844.9	341.0
1994-95	112.00	78.89	39.54	230.4	83.9	9.0	2.52	1225.3	446.1
1995-96	138.38	96.94	44.12	279.4	94.5	10.1	2.62	1490.5	503.9
1996-97	155.85	96.32	44.39	296.6	94.3	8.9	2.40	1564.7	497.3
1997-98	190.21	81.59	46.56	318.4	96.5	9.0	2.30	1676.6	508.4
1998-99	224.96	83.14	49.37	357.5	101.4	8.3	2.22	1872.7	531.4
1999-2000	262.71	62.07	52.18	377.0	104.0	8.8	2.13	1964.3	542.2

Source: Mehra, et.al; 2003.

Notes:

(i) For fertilizers, subsidy has been computed 1981-82 onwards due to lack of availability of relevant information.

(ii) Some figures for later years are based on estimates.

Agricultural GDP figures from 1993-94 onwards are from NAS (2000).

For 1999-2000 it is assumed to be that in 1998-99, GDP figures for 1999-2000 are estimates from NAS (2000).

Gross Cropped Area is projected for the years after 1996-97.

Pollution control	3.4	3.3	3.5	1.9	1.9	1.9
Mining	2.6	2.2	1.9	2.3	2.1	2.1
Bio-electronics	3.3	3.0	3.5	2.4	1.8	1.3

Impact expected by year 2000
5 = Very High; 4 = High; 3 = Moderate; 2 = Low; 1 = Very Low

Source: Ralph W.F, Hardy 'Bio-technology Status Forecast and Issues', 1985.

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