Ecosystem Services

Incentivising and Providing Common Ecosystem Services in the Agricultural Sector

(Discussion paper)

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Introduction

Agriculture is in crisis on two fronts around the world. On the one hand, agriculture is not remunerative for farmers and people who depend on it. This has caused an increasingly large number of people to move away from agriculture into other professions. From almost 40% of Indian national income in 1970, agriculture's share of national income has fallen to just 15% in the year 2009- 10.1. This has meant the neglect of rural areas as the share of income coming from these areas has been continuously falling causing a lower interest in investment in these areas. Urban areas share of national income has increased from 37.7 per cent in 1970-71 to 52 per cent in 1999-2000 and is projected to increase to 75% in the year 2030.[2] Despite the continual falls in rural (and agricultural) income, the sector continues to employ around 60% of the total population in the country.

While agriculture employs a large proportion of the population, it also occupies a substantial part of the land area of the country. This opens up the second crisis of agriculture. Given the pressure to produce more food for human consumption, larger and larger land areas have been under put under cultivation with a constantly shrinking area for living ecosystems. The area under cultivation in India is around 60% and it has been constant after reaching this level about ten years ago.[3] The increasing area under cultivation has both reduced the area of common lands and uncultivated land and at the same time put pressure on forests: shrinking an already small forest cover even further. Increasing areas under cultivation together with intensive methods of cultivation using pesticides and fertilisers has had long term effects on soil and water quality across the country. Soils have degenerated and an increasingly large number of water bodies have witnessed higher levels of nitrification, causing deterioration in water quality.

The response to the crisis in agriculture has varied across the world. While some countries have responded to the crisis through a shift away from the chemical intensive methods of agriculture, others have increasingly promoted organic agriculture to reduce the impact on the environment. Given the dominant narrative that organic agriculture will result in lower outputs, it has been a challenge to shift cultivation patterns from single crop, intensive agriculture to the traditional multi-crop, low energy system. Ensuring that changes in cultivation patterns do not result in a consequent fall in incomes is a key part of any government policy initiative.

Given falling farm incomes, a key focus in government policy is currently the stabilisation and growth of income, given that the minimum support price mechanism in India is increasingly failing to provide income support for vulnerable farmers. This paper looks at policy interventions that could maintain agricultural farm incomes, and incentivise ecological practices that promote the long term sustainability of the planet.

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[1] The Report on Indian Urban Infrastructure and Services, March 2011, High Powered Expert Committee (HPEC), Ministry of Urban Development

[2] The Report on Indian Urban Infrastructure and Services, March 2011, High Powered Expert Committee (HPEC), Ministry of Urban Development

[3] http://data.worldbank.org/indicator/AG.LND.AGRI.ZS

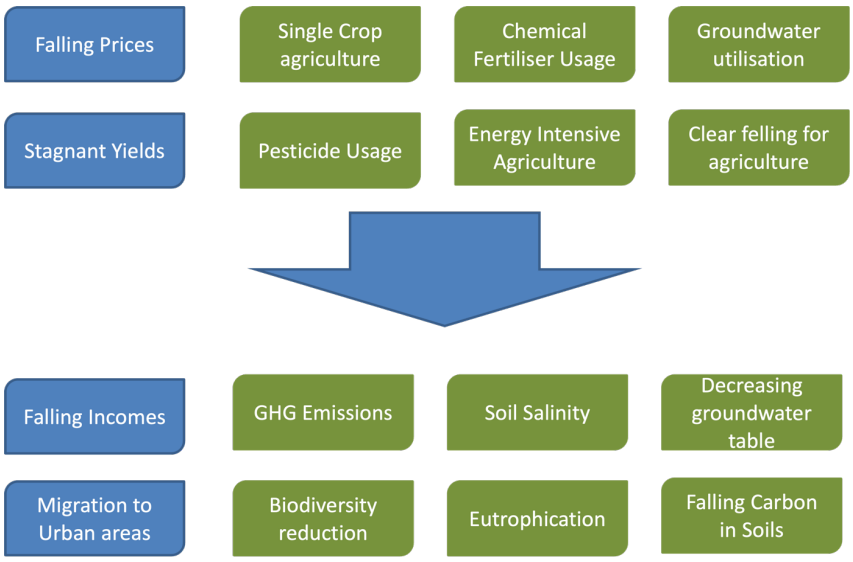
The Economic and Ecological Crisis

Globally, it is estimated that between 38% - 50% of all land is in agricultural uses.[4] With nearly half the land area of the planet under agriculture, its impact on the ecosystem is tremendous. Present agricultural models involve the use of intensive methods to clear regions and rely on mono- cropping methods using fertilisers and pesticides to create high yielding regions of a single crop. Yield per acre and the consequent income per acre is the measure of success of such forms of agriculture.

$$\text{Farm Income}_X = \text{Yield}_{\text{Crop A}} \times \text{Price}_{\text{Crop A}} + \text{Yield}_{\text{Crop B}} \times \text{Price}_{\text{Crop B}} \times \ldots$$

Farm income per acre as shown above is a function of both Yield and Price. As the globalisation of agriculture has resulted in falling prices (with a brief period around 2008 where prices rose), the focus of agriculture has been to increase yield in order to increase income for the farmer. Due to the uncertainty of the monsoons, yields of a particular farmer can go up and down dramatically year on year, especially when single crop pattern agriculture is used. Despite the increasing yields witnessed due to chemical intensive agriculture, farm incomes have been falling, with widespread destitution pushing many farmers to commit suicide.[5]

Fig 1: The Present Agricultural Crisis



In addition to falling agricultural incomes, agriculture has been ravaged by the widespread use of chemicals that have resulted in damages to the ecosystem. It is now widely acknowledged that there has been widespread loss of biodiversity across the world, and intensive agriculture has been a major driver of this global change. This has been witnessed in areas that have intensive agriculture as well as areas that have been

4 VH Dale and S Polasky, Ecological Economics (2007), doi:10.1016/j.ecolecon.2007.05.009, Measures of the effects of agricultural practices on ecosystem services, p 1

5 P Sainath, 2013, Farmers' suicide rates soar above the rest http://www.thehindu.com/opinion/columns/sainath/farmers-suicide-rates-soar-above-the-rest/article4725101.ece

untouched by human activity.[6] Single cropping patterns have resulted in very little non-crop area, reduced numbers of old trees and forests that remain in common lands, causing habitat fragmentation for many species. This is visible through the loss of many farmland birds, insects, spiders and arable weeds that has been widely documented around the world.[7] Other practices that cause widespread damage on the ecosystem include reducing crop durations, increasing inputs of farm fertilisers, and the adoption of practices like deep ploughing (as opposed to minimum tillage). Traditional, low intensity agriculture contributed greatly to biodiversity. This has increasingly become under threat due to the intensive agriculture cultivation practices that is being followed presently. Biodiversity is also affected indirectly through increases in nitrogen (N_20) and CO_2 emissions. One of the key reasons for the reduction in biodiversity was because farmers had a de-facto initial assignment of property rights that allowed unrestricted use of their private land as well as any water below their private land. This results in an over- exploitation of common property resources and a shortfall in the production of public environmental goods.

Agriculture is also a major contributor to climate change, as it has an impact on all three major greenhouse gases (CO_2, CH_4 and N_20). It is estimated that about 12- 14% of the total global greenhouse gas emissions stem from the agricultural sector. Methane and Nitrous Oxide are the two gases that are predominantly attributed to the agricultural sector. Another significant effect of chemical intensive agriculture is eutrophication. Eutrophication is the nutrient enrichment in sensitive ecosystems. It leads to excessive growth of algae and excessive oxygen demand, with anaerobic conditions leading to foul smelling surface waters and fish death. Several studies have shown that nitrogen leaching can be reduced by between 40- 60% through organic farming. Studies indicate a lower eutrophication potential of organic farming. They have lower directly available nitrogen, though nitrate leaching can be a bit high at some points in the cropping cycle.[8]

Other effects of the chemical intensive methods of agriculture have been an increase in the usage of underwater water resources in order to meet the needs of single crop inorganic farming. While in the earlier days, the availability of surface water and rain limited the spread of agriculture, the practice of sinking tube-wells or bore-wells has meant that underwater resources are now used to irrigate crops. In many parts of India, tube wells are sunk to depths of more than 600ft. In addition, the rate of fall of groundwater has been estimated between 10cm per year to 50cm per year, depending on the area of the country.[9] This alarming fall in groundwater has also coincided with a drop in soil carbon content due to the use of chemical fertilisers. No longer do soils have to be maintained, but they are seen purely has a holding medium into which different chemicals can be applied in order to grow a particular crop. Soil Carbon levels have been falling across the country: in both dry and wetland areas.

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6 Teja Tscharntke, 2005, Landscape perspectives on agricultural intensification and biodiversity – ecosystem service management, Ecology Letters (2005) 8, p 858

7 Teja Tscharntke, p 858

[8] Supra p 194- 196

[9] http://news.sciencemag.org/environment/2009/08/indias-groundwater-disappearing-alarming-rate

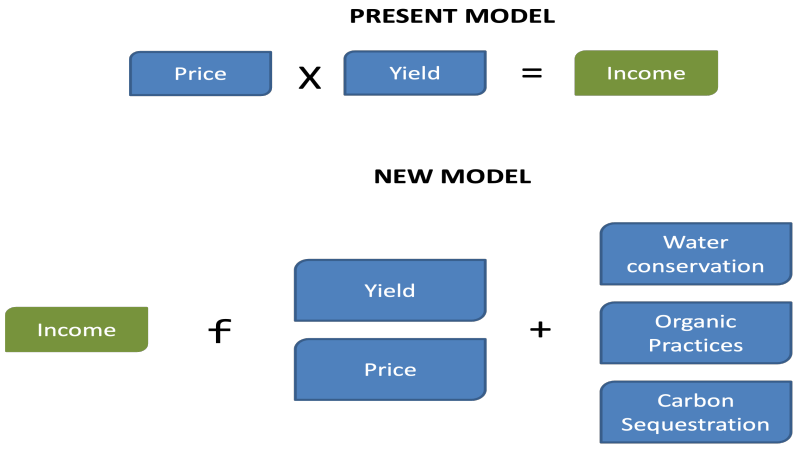
What are the possible remedies?

Given the crisis facing agriculture, the key question upon us is how to ensure that farm incomes are protected and at the same time ensuring a more ecological way forward for Indian agriculture. Linking these two policy imperatives requires a different approach to looking at the agricultural sector. The first step would be to stabilise farm income and de- link it from the two factors that it depends on: yield and commodity prices. The second would be link the higher guaranteed incomes of farmers to ecological practices that can be practised on an ecosystem wide scale. This means linking payments with not just yield and price, but also with water conservation remedies, organic agricultural practices undertaken as well as carbon sequestration practices.

Driving this change would require establishing a mutual relationship between demand and supply, linking increased money from the tax payer pool that will go to ecological practices in order for increased food safety guaranteed by farmers that are given grants to farm so that the long term sustainability of agriculture and the planet are taken care of. While the Swiss example is different from the Indian context in many respects, the key learning from their experience was that the demand side for safe food drove the political consensus to create financial and other incentives for organic and sustainable farming within the country.

As highlighted in the diagram below, it involves the shift away from the present model where farm income is dependent exclusively on the yield that a farmer gets as well as the price of the produce. Some amount of protection is factored in India with the Minimum Support Price (MSP) procurement system for rice, wheat and some pulses and oilseeds. This support does not however protect farmers against adverse yields which are a reality for a number of rainfed farmers whose yields drop with the failure of a timely monsoon. Additionally, a large number of crops are not covered under this umbrella, which means that many farmers still have to contend with both price risk as well as yield risk. Farmers are offered limited protection against yield risks through the Modified National Agricultural Insurance Scheme (MNAIS) and the Weather Based Crop Insurance Scheme (WBCIS). These schemes have generally worked better in the plantation sector where margins are higher, than in cereals, pulses and oilseeds.

Fig 2: Changing the Paradigm: Income models for farmers



Moving away from the present model where the income of a farmer is dependent purely on yield and price involves designing a scheme that involves moving away from the present practice of passing all risk to the farmer through the operation of the market mechanism. Cushioning some of the risk will be integral to the functioning of any new system. At the same time, moving towards a system where a farming community can be incentivised to move towards ecological farming can be one of the challenges. Questions that arise include what are the ecological services that need to be incentivised and provisioned, how can the system be designed and what have been the practices of incentivising ecosystem services in other countries?

Using these three questions as a background, the next section will outline the broad areas of ecological practices that can be provided an incentive. Additionally, it will look at how these incentives can be structured using the examples of these systems in other countries. Finally, it will look at a system design for a proposed payment for ecological services in India.

Common Ecosystem Services

Water conservation

Agriculture is one of the key users of water with some crops being particularly water intensive like paddy and sugarcane. The availability of sub-surface ground water through the exploitation of borewells has resulted in an increase in the cultivation of water intensive crops, sometimes at the expense of crops that require less water. Together with the financial incentives through a minimum support price for paddy and sugarcane, this has gradually resulted in a shift to these water intensive crops.

The result of this process has been an increasing number of borewells that have been sunk in the country, resulting in a reduction of per capita water availability from 3,000 m^3 of water in 1951 to 1,820 m^3 in 2001. This has been driven by the increasing number of borewells that now take care of 40% of the total irrigation needs of the country. It is estimated that there are around 27 million groundwater structures in the country.[10] The increasing pressure on groundwater has resulted in an increasing usage of these resources for agriculture. As the study above suggested, despite near normal rainfalls in many years, groundwater levels continue to fall dramatically. In some areas groundwater has fallen by as much as 0.4 m over a short period of 4 years in periods of normal rainfall.

In addition to the falling levels of groundwater, it is increasingly clear that the water itself is contaminated with many minerals beyond safe levels. Arsenic, Fluorides and other chemicals are common contaminants found in sub surface ground water. Given both the falling levels of groundwater and the contamination of groundwater, it is increasingly necessary to ensure that groundwater levels in the short term do not fall any further and in the medium term increase across an ecosystem. Reducing the increasing dependence on groundwater could involve moving away from water

[10] P S Vijay Shankar, Himanshu Kulkarni and Sunderrajan Krishnan, 2011, India's Groundwater Challenge and the way forward, Economic and Political Weekly, Jan 8, 2011, Vol XLVI No. 2, pg 37- 40

intensive crops like sugarcane towards pulses and millets, increasing rainwater harvesting practices and surface storage of water as well as a gradual reduction in the number of tubewells that are sunk, with incentives to villages and areas that reduce the number of tubewells in use.

While it would be administratively foolhardy to dismantle a reasonably well functioning public procurement system with price support that is generally used by paddy and sugarcane, a new system can be put into place in areas with lower rainfall where paddy and sugarcane are not staples. These could initially be drier areas, with lower levels of irrigation, where fewer water intensive crops are used. Given the rain reliant nature of agriculture in these areas, they also have a large number of vulnerable farmers and focussing on supporting these farmers would fit into the present focus of governments. While incentives at the present moment will be for all farmers, and farm related labour in a particular area, it will be linked to more sustainable usage of groundwater in the long run.

Addressing groundwater levels across an ecosystem therefore will require moving away from the 'groundwater anarchy' as Tushaar Shah explains the present system towards one where there is a common understanding of water usage and an optimal utilisation of water. This would require not a single farmer to participate in an isolated farm, but the participation of all farmers across the ecosystem in order to ensure that optimal water management practices are put in place. The advantage of such a system would also be that when all farmers in a region participate, all become both participants and beneficiaries in a system.

Soil Carbon Sequestration

One of the results of the indiscriminate use of chemicals to cultivate has been a gradual and steady decrease in Soil Organic Carbon (SOC). This causes deterioration in the soil as SOC affects the water retaining ability of the soil as well as reduces the ability for other life to thrive in soils. A fall in SOC is generally associated with a decrease in the number of microbes in the soil as well as earthworms and other animals. This makes the maintenance of SOC an important activity for the ecosystem, though the incentive for the individual farmer to maintain it is very small.

This is because, individual farmers with the use of chemical fertilisers, use soils only as a medium to grow with all other nutrients being supplied through chemicals including DAP and Urea. The maintenance of soil carbon is therefore not a significant issue in the case of chemical intensive agriculture. Soil carbon however, plays a very important role in the health and well being of the soil systems.

As highlighted earlier, soil carbon allows for micro-organisms to grow and thrive. Microbes are a crucial part of soil systems and provide a range of micro- nutrients for plants to thrive. Soil carbon increases the water holding capacity of the soil, which is important and plays a role in the water cycle to ensure that water is retained in the soil. Soil carbon is a part of the carbon cycle, formed as a part of decaying plant material after their formation through photosynthesis. The presence of soil carbon highlights the presence of active above soil plant life that is important to the ecosystem. Soil Carbon

also helps to maintain biodiversity within soils and above soils as it plays a key role in ensuring plant and animal life.

Like in the case of water conservation, individual farmers have less of an incentive to maintain soil carbon as the use of chemical fertilisers can ensure yields, without the need for soil carbon to be at a very high level. This means that the maintenance of soil carbon needs to be undertaken at an ecosystem level, creating a context where all farmers in a particular region have an incentive to increase soil carbon. This is especially the case as activities that require increases in soil carbon including planting of hedgerows, leaving land uncultivated and other activities would not be possible for small farmers due to the small size of their land holding. Looking at the entire ecosystem and rewarding particular farmers for their contribution to the health of soil carbon will have to be a crucial part of any system that is designed to increase SOC.

In order to ensure that SOC goes up and continues to be preserved, a key factor would be to maintain common lands as well as creating ecological fences that can reduce erosion due to water or wind. Similarly, while grazing animals can be useful sources of manure and SOC, overgrazing can cause a reduction in SOC. A key part of any policy measure that works on SOC will have to learn from the Swiss example, where the numbers of cattle are regulated in a grazing land. This results in the maintenance of the pasture land to ensure that they

Biodiversity promotion

One of the effects of the chemical intensive method of cultivation has been a loss of biodiversity across a habitat, due to various reasons. One of the reasons has been the loss and fragmentation of the habitat of particular species. Every species has a range, beyond which it cannot move. The key to ensure that these species have diversity within the species would be to ensure that their habitat is not fragmented in order to ensure that there is sufficient diversity in the gene pool. This means that particular habitats need to be maintained in a contiguous manner in order to ensure that these particular species survive. Again, working with communities so that habitat is not fragmented will be an important part of the work at local levels. Building habitat that connect with each other, and ensuring that there is a no cultivation/ grazing land are important steps to promote biodiversity.

In addition, the widespread use of chemicals in fertilisers, pesticides and weedicides have resulted in a reduction in both plant and animal life due to their toxic nature. This has resulted in a decrease in biodiversity witnessed through the reduction in keystone species like bee populations. Bees and similar insects are critical to the ecosystem as they help in pollination and are a crucial link in the foods chain. In many countries including the USA, a reduction in bee populations have resulted in the need to bring in bee colonies to pollinate fruit orchards. Pollination is known to increase yields by between 20- 30% and therefore play a critical role in the ecosystem.

While many studies have been conducted on the effect of pollination on yield, limiting it to that can be a very narrow utilitarian view of bees in the ecosystem. Insects in the air and microbes in the soil reflect the vitality and dynamism of the surrounding ecosystem, in addition to providing increases in productivity for particular crops. Fruits that are produced through the pollination process are generally of better quality and are greater in number. The benefits for avocado for example range from an increase in 0.3 tonnes/ ha in year 3, to 20

tonnes/ ha in year 9.[11] This highlights that it is important to look at a time series over which the benefits are visible, rather than a single point of time where the benefits are less clearly visible. A study in Gujarat (Valsad) in the year 2012, showed inconclusive results with massively higher productivity for some crops in areas with bee boxes and significantly lower productivity in other crops for the same areas. Similar variations are seem for increases in production for mangoes (90%) and between 10- 20% for peanuts and grapes.[12] The same study highlighted that coffee yields probably increased by 36% in the presence of increased pollination by honey bees. At an aggregate level, the economic valuation of pollination services is tremendous: Constanza suggests that the value could be in the range of $ 120 billion across the world, while other estimates suggest that it could be closer to $ 200 billion.

Many of these studies look beyond productivity in order to look at increased biodiversity and other benefits from an increase in pollination. This could also mean lower pesticide residues and other stronger fruits and the strengthening of the species against diseases that eventually have long term benefits for a particular ecosystem. While productivity is short term indicator, successful interventions will look at longer term measures as well that improve the biodiversity of a particular area.

How can these systems be deployed?

As highlighted in the section earlier, the key task ahead is to ensure that not just individual farmers benefit, but all farmers in a particular ecosystem actually benefit from the system. This means the use of incentives structures that not just promote these practices on a particular farm, but also in the ecosystem around it. This means that these practices need to be incentivised at an ecosystem level or a watershed level, or at any other level that is deemed to be appropriate. This for example means that while individual water conservation methods need to be encouraged, payments and incentives need to be crucially based on community level benchmarks. Key questions also remain on how each of the payments that are made to a particular watershed are then distributed to each farmer, but that could come out of a process of local negotiation to ensure that every farmer does not get anything less than what they presently get under the open market system. This could be through a fee per acre allocation for a particular farmer, with a larger amount going to them if their land is left fallow and a smaller amount going to them if the cropped.

Water Conservation practices

Putting in place water conservation practices is one part of the entire package of measures that can ensure that farmers incomes are protected and at the same time the surrounding ecology is enhanced. While one part of the solution can be the deployment of low water usage techniques including sprinkler and drip irrigation where appropriate, the key challenge would be to ensure to manage the existing resources of water so that there is no further depletion of groundwater. The key benchmarks that can be used could include:

1. Depth of groundwater table: One of the key indicators that can be considered is the depth of the groundwater table. Given the rapidly falling levels of groundwater across the country, this indicator will incentivise communities to both reduce water usage as

[11] http://archive.agric.wa.gov.au/PC_91826.html
[12] FAO, 2006, Economic Valuation of Pollination Services: Review of Methods.

well as recharge groundwater through better groundwater management. The reduction in groundwater usage and extraction together with conservation and management of groundwater should result in an increase in groundwater levels: the key indicator that can be measured based on which payments to farmers can be made.

2. The number of borewells in use: One of the key sources of water for irrigation is through borewells or tubewells. While in the initial years, it was only very large farmers who could afford to have borewells, increasingly, a large number of medium sized farmers are now investing in borewells as they see this as a way to reduce the risks and uncertainties of the monsoons. This has resulted in a massive increase in the number of borewells across the country, in nearly every district. This is especially true in the grain basket of the country (Punjab, Haryana and western UP), but also now in areas like Tamil Nadu and Karnataka. Another measure that could therefore be used to measure the extent of conservation of rainwater is the number of borewells in use in a watershed/ district. The lower the number per square kilometre, the higher could be the payout for the district or the watershed
3. The number of litres of groundwater extracted: This system is a slightly modified one of the earlier one, where every borewell would be metered, and based on the total amount of water extracted, payments can be made to farmers in a particular district.

Carbon Sequestration and Soil Conservation

Maintaining the level of soil carbon is one of the key indicators of soil health and at a district or watershed level, samples of soil can be taken in order to measure changes in carbon content over a period of time. Increases in soil carbon over a period of time can be rewarded, as an incentive for all practices that lead to increasing carbon in the soil. If the measurement of carbon in soils is difficult, the other ways of rewarding a similar process would include:

1. Leaving particular areas in the watershed/ district uncultivated and untouched (in the initial years, it might even be necessary to fence off the area to ensure that no cattle grazing is allowed)
2. Restriction in the number of cattle allowed in a particular area
3. Plantation of particular species of plants and trees in common areas
4. Restoration of forested areas and the establishment of contiguous habitat to increase biodiversity

Biodiversity Enhancement

Similar to the methods of carbon sequestration earlier, all the measures suggested above have an immediate effect on biodiversity. However, in a particular area, there are often key species that highlight the good health of a particular ecosystem. This means that the health of the ecosystem can be measured by how endemic a particular species is. Some of the measures that can be used include:

1. The number of bee colonies in a particular quadrat
2. The number of butterfly species identified in a quadrat
3. The number of endemic local varieties of trees present in a quadrat

Designing a Payment for Ecological Practices System

This paper is an initial discussion on the possibilities to design a payment for ecological practices system. At the heart of it is a change in the way that incentives presently are directed at the maximisation of individual profit for a farmer and moving towards one where the mutual coexistence of all people living in an ecosystem is recognised. Recognition of common ecosystems and services required for humans as well as the environment is an important step forward from the current paradigm of productivity at the cost of the environment. Creating the system needs to emerge from a demand for safe food that has minimal impact on the environment, and that gives farmers and people who rely on the land a secure and stable livelihood. Combining these practices requires us to redefine our relationship with the market system, providing assistance to negate the effect of negative externalities like ground and water pollution and contamination of food.

Providing incentives for ecological practices within an Indian context can be a challenge given the physical, social and ecological complexities of each region. Establishing a system that can be implemented and monitored locally, but supported from the State or Central level would be critical to ensure its success. While there is a shortage of capital at local levels, the frameworks that have been established across the world can provide the necessary guidance to the implementation of a local system. A possible step by step process of the same could include:

1. Local communities define a particular watershed/ ecosystem area which is approximately the size of the local gram panchayat.
2. Based on local consultations, a proposal is drawn for the entire watershed to protect and enhance the local ecological balance.
3. The proposal is then submitted to the gram sabha that approves the plan and submits it to the State Government.
4. Based on a consolidated list of plans, the State government allocates funding to each gram sabha
5. After funding is released, the plans are implemented and monitoring is made both at local and State levels
6. Regions that show most improvement can be supported to take forward their plans.

Frequently Asked Questions

1. How will farmers be compensated?
   Farmers in areas that participate in the scheme will be compensated for their participation. The entire plan that will be evolved will compensate farmers based on a local plan that has been agreed upon by the panchayat/ local administration. Changes in land use will need to be recorded and people compensated accordingly based on whether their lands continue to be used for farming, or if they form a part of a habitat conservation zone. Compensation will then have to be arranged accordingly. The income that the farmer gets will be based on considering costs of cultivation calculated by the Commission for Agriculture Costs and Prices (CACP).
2. How will interests of labourers and cattle owners be taken care of?
   Labourers and cattle owners interests will be articulated and taken care of through the local area plan. One of the primary areas of interests will be the development and preservation of common lands. At the same time, the number of cattle will also have to be defined based on

the carrying capacity of the ecosystem. Agricultural labour will also need to be compensated if there are losses that are suffered by them, but it is possible that this can come through the MNREGA scheme that is presently operational.

3. How will progress be measured? Verified?
   Progress will be measured against the indicators that are already present in the local area plan. This could be in terms of common areas developed, watershed management practices commenced, planting activities commenced and soil carbon sequestration. Indicators that are already specified in the plan will be reviewed and payments will be made based on the progress made against these indicators.
4. What will happen to the Minimum Support Price programme?
   The minimum support programme will continue as this programme is likely to be in rain fed areas, where the key MSP products: paddy, wheat and sugarcane are not grown. The focus would be on areas where crops such as pulses, oilseeds and millets dominate. Many of these products if are a part of the MSP, will be sold at that price. However, the key calculation would be the cost of cultivation and a reasonable income based on the cost as estimated by the CACP.

Case Studies

Switzerland

The traditional system of incentives in the Swiss system was to incentivise higher production through payments linked to production volume. This system led to higher production volumes, but often at the cost of the environment, increased nitrates in the soil as well as a general degradation of the environment. Widespread dissatisfaction against the system was articulated both by farmers who felt that incomes were going down and by the general public who increasingly felt the need to protect their natural ecosystems that had considerable cultural, aesthetic and tourist value. What emerged out of a long process was an agreement that farmers in Switzerland need to be compensated better, but at the same time an increased focus on the usage of ecological methods to improve both landscapes as well as agriculture.

Recognising the need to change the system to improve export competitiveness and ecological sustainability, the new agricultural policy seeks to make direct payments to farmers not based on production, but on a variety of other factors. The agricultural policy of 1993 aimed at improving many aspects of their agriculture including the productivity as well as the ecological performance of agricultural systems. One of the key challenges that is faced by Switzerland was the high cost structure of agriculture and the need to create viable models that can provide for a measure of food security of the country. The substantial difference in policy was a dramatic scaling down of benefits to agriculture from the highs in agricultural support in the 1990's. At the same time import controls have reduced and contributions towards market price support including export subsidies dropped from a total of 8 billion francs in 1990 to 5.6 billion francs in 2010.

The main focus of the agricultural policy in Switzerland was a greater focus on markets and an increased promotion of innovation and increased value. At the same time, the focus of the interventions was to create conditions for further deregulation of agriculture and the elimination of

ineffective incentives for agriculture. One of the key objectives of the new agricultural policies was to ensure more efficient use of natural resources and at the same time promote targeted promotion of services to the community. Direct payments are made in Switzerland not in terms of the acreage, but in terms of the total welfare that can be improved through the intervention. Some of the key welfare improvements that are the focus of the improvement include:

- **Animal welfare standards:** Switzerland has a very large dairying and meat industry. During the earlier focus on agricultural improvement, the focus of Switzerland was to increase productivity and production of both dairy and meat products. However, new standard set also include adequate grazing on pasture land for animals, a managed quantity of processed feed as well as time spent outdoors for the animals.
- **Balanced use of fertilisers:** Traditionally, the focus on increasing production in mono-crop agriculture resulted in a continual increase in the use of fertilisers. The new system encourages a balanced use of fertilisers to ensure that there is lower levels of leeching and pollution of ground water.
- **Ecological compensation areas:** 7% of the total land area of a farmer should be kept aside as ecological compensation areas for biodiversity purposes. This means that there will be minimal human intervention in these areas, so that they can become a hotspot for wildlife. Over a period of time, there has been a target to connect these ecological compensation areas to each other, so that they form one continuous habitat for wildlife.
- **Crop-rotation**: Moving away from the single cropping system to where crop rotation forms an important part of the agricultural system was a major change in the Swiss agricultural policy. Multiple crops within the same season was encouraged with as was using different crops as biological controls and fences using different crops.
- **Soil protection**: A key part of the new policy was the protection of soil through the planting of hedgerows and the placement of barrier trees and plants at the edge of the properties to prevent erosion. Soil protection and prevention of erosion was done from a complete catchment perspective.

The result of the policy has been an improvement in productivity by 1.6% per year, and an increase in gross and net calorie production by 10% and 5% respectively. At the same time, the negative effects of agriculture have reduced. This means that the loss of nitrogen was down by 14% and the loss of phosphorus was down 70%. At the same time, the total area farmed land aimed at increasing biodiversity has increased considerably and the percentage of high quality farmland has also increased. As a result of this policy, it is also expected that livestock numbers will fall by 10%, as payments are moved away from livestock payments to one that guarantees food supplies. The payments that are meant to ensure high quality biodiversity areas are likely to lead to improvements in biodiversity, and at the same time help in an increase in calories by 3% of more going forward.

Costa Rica

Costa Rica is a small country in central America that has a population of around 4 million people. It was one of the first developing countries to conceptualise and implement a PES system to improve conservation of forests. The focus of this move was to move away from the timber only approach that rewarded private farmers for cutting forests down to one that had a holistic recognition of all the ecosystem services that a forest provides. This emerged out of a scenario when like in many

countries, the protection of forests outside of the national parks and reserves became a challenge as farmers owning property on the edge of the reserve had little incentive to protect it.

The programme in 1996 emerged out of the post Rio deliberations, where there was an agreement that farmers who own forests should be paid for the externalities that they produce, and those that benefit from them should pay for these services. The Costa Rican payments for environmental services programme was formed through the Forestry Law 7575 and recognised that private farmers need to be compensated for four of the services that they provide. These include:

- Mitigation of greenhouse gases (reducing, sinking, fixing and storing carbon)
- Protecting water for rural, urban or hydroelectric use
- Protecting biodiversity for conservation, scientific and pharmaceutical use
- Landscape beauty for tourism

There have been attempts to measure the outputs, especially that of carbon sequestration. However, the payments to farmers do not depend on the quantity or quality of the environmental service. In exchange for the payment received, private landowners agree to specific land uses (for example protection of existing forests, reforestation in areas where natural forests have been denuded, forest management, natural regeneration or agroforestry. The large majority of the money spent currently (70%) is for forest protection, followed by reforestation (20%) and forest management (10%). This was not the case initially, as a large bulk of the funds in the initial years went for reforestation. However, over the years, this has dropped considerably over the years, with reforestation not accounting for more than 15- 20% of the total budget spent.

The programme began initially with support from Norway for the sale of carbon credits with a private company called Energia Global. However, it is presently funded by a fuel tax that is placed in a trust fund. At the same time, a significant portion of the funding comes from contracts that are signed with hydro electric companies that are seeking to purchase ‘carbon credits’. The programme is managed by the National Forestry Fund (FONAFIFO). Depending on the service provided, contracts are handed over to farmers for a period of five or ten years. In the initial years, ownership of the land was a necessary condition in order for farmers to benefit from the programme. However, in subsequent years, participants in the programme only needed to demonstrate ‘clear possession rights’ in order to receive payments from the system.

The next phase of the project was started when the managers of the programme realised that poorer areas of Costa Rica could not participate in this programme, as they were on the edges of the forested areas. The result was a move that modified eligibility criteria so that that all participant farmers had to have an Social Development Index (SDI) < 35. This was raised to 40 in subsequent years. The Social Development Index measures social differentiation in different geographic areas of Costa Rica (cantons). It is based on several social variables, including education infrastructure, child mortality, average electricity consumption in residential areas and the proportion of children born to single mothers. At the same time, the project also began a major reforestation initiative called REFORESTA as it was increasingly becoming necessary to initiate large scale reforestation activities in the country.

One of the major criticisms of the programme is that it while it has been a good measure to ensure a reasonable scale of reforestation in the country, it was targeted at benefiting private landholders.

This excludes landless people, national parks and public lands from its portfolio. At the same time, while there is an upper limit of 300 hectares (600 for indigenous people) for support from FONAFIFO, there is no restriction if a landholder applies for 300 hectares in one year, and for another 300 in the year after. This has meant that some of the equity concerns with which the programme was established, have fallen by the wayside. Private companies that were owners of lands in Costa Rica, were the biggest beneficiaries of this system. Indigenous people received 2% (US$ 22.4 million) of the total number of the contracts given out, even though it represented around 10% of the total value of the contracts. However by the year 2008, the contract value of what was paid to indigenous people had risen to 23% of the total contract value. Private companies receive about 28% of the total value of the contracts.

Another criticism of the system is the high transaction costs that were borne as a part of the system. It is estimated that transaction costs can form a total cost of upto 18% of the total costs of operations. Many farmers joined the system through an intermediary as they felt that the complexity of the system made it difficult to join and access it. Additionally, the scheme required that participants had paid their local taxes and did not owe money to the National Health System or that their land had not been a part of the IDA land distribution system. Additionally, properties had to have clear titles and should be free of mortgages.

Australia

The Landcare movement emerged in the 1980's to the widespread degradation of soil, the loss of biodiversity as well as the extinction of many species in Australia. This was a result of over 200 years of European colonisation that resulted in the degradation of soil and water, an increase in pest infestation as well as soil erosion. While the industrial farming helped increase income and moved Australia to be one of the largest exporters of agricultural and dairy products, it was very destructive on the native environment in the country. The Landcare initiative emerged as a voluntary grassroots movement of local community groups who act as caretakers of the natural resources of the country.

Landcare started several programmes across Australia to restore soil and water quality which was widely regarded as being degraded. Presently, Landcare is a network of over 6,000 groups across Australia and many more farmers and landowners who are not formally a part of the network, but carry out land improvement without formally being associated with the programme.[13] The programme began in the Australian state of Victoria where soil conservation programmes began due to the need to control salinity in many areas. The programme expanded after creation of an alliance created between the National Farmers Federation and the Australian Conservation Foundation.[14]

Landcare support is generally given to groups that range from around 5 members to 200 members. Membership is voluntary and is open to any person. The groups operate at a catchment level, meet regularly to discuss issues and identify priorities, conduct field days and farm walks, plant trees, building salinity and erosion controls, pest, animal and weed control and ensure protection of native vegetation. Other activities that groups are involved in include the establishment of wildlife

13 Department of Agriculture, Government of Australia. Accessed from http://www.daff.gov.au/natural-resources/landcare

14 Rob Youl, Sue Marriott and Theo Nabben, 2006, Landcare in Australia: Founded on local action, p5

corridors, organisation of conferences, writing of newsletters, as well as coordination of various Landcare education projects.[15]

The original focus of Landcare was in the improvement of agricultural practices that will lead to higher yields. Landcare applications are made by groups around a catchment area. The groups are required to make a formal application based on which funding will be released by the programme. These forms are evaluated and based on the approval form a part of a regional landcare action plan (RLAP). Funding is conditional on the achievement of targets that are specified in the original application.

One of the key features of Landcare has been that it had in place networks of communities, so that one community could learn best practices and share experiences with others. This resulted in a mutually beneficial ecosystem for members of Landcare. Many communities actually did visit each other and have benefited from interactions with each other. Landcare was established thanks to the strong partnerships that local communities were able to identify in their local areas. While a large part of the funding came from the State, local communities were required to invest in order for the federal funding to be approved. After the decade of Landcare in the 1990's, it has not been able to maintain the same momentum without significant State support. Presently, the market for Landcare still exists through voluntary contributions from citizens and trusts to support initiatives across Australia and some support from the State.

15 Alan Curtis, Jim Birckhead and Terry De Lacy, 1995, Community Participation in Landcare Policy in Australia: The Victorian experience with Regional Landcare plans, Society and Natural Resources, Vol 8, p 417