

IMPACT OF CLIMATE CHANGE AND HIMACHAL PRADESH'S ACTION PLAN STRATEGY ON FORESTRY

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Introduction

During the recent past, weather patterns all over the world are changing and Himachal Pradesh (HP) state is no exception. Climate change may manifest most in HP through warming and rainfall changes. The impacts are likely to adversely affect a large percentage of the state's population dependent on natural resources. There is a clear indication of climate change having a direct impact on the vegetation, natural and cultivated, as also on the availability of water in the rivers and streams. At the same time, land which is not presently available for forestry (being under permanent snow cover) could gradually convert to grass land/forests.

Possible Impacts of Climate Change

Rabindranath (2008) warns, that the future climate signs for HP are not favourable at all :

1. HP forests, especially higher altitude ones, are highly vulnerable and forest types shifts are predicted to occur in >80% of forested grids.
2. Forest fire occurrence may increase and forest productivity may increase initially. He highlighted that the forestry option is the best.
3. The change (increase) of temperature is likely to be plus 3°C. This would be especially disturbing for this small Himalayan Indian State whose footprint is merely 0.4 t CO₂ (the per capita figure for carbon emission in HP= 0.11 t C; while the average total yearly emission of HP is 660,000 t of C). Glacier melt in the Himalayas is projected to increase flooding; rock avalanches from destabilized slopes and to affect water resources within the next two to three decades. This will be followed by decreased river flows as the glaciers recede.
4. The rainfall is projected to increase during June to Sept. This may lead to increased occurrence of floods and flow in to rivers and dams and have significant impact on food production, water and forests.

Options available for mitigation

The options available for HP are mitigation measures to reduce the pace and magnitude of the changes in anthropogenic climate change activities or adaptation measures to reduce the adverse impacts on human-well being as a result of the climate change occurrences -- enough mitigation to avoid the unmanageable, enough adaptation to manage the unavoidable. The possible mitigation

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forestry strategies required to be implemented are to reduce GHG emissions and enhance carbon sinks in soils and forests, especially thorough re-forestation.

Reafforestation : Reafforestation as an option has its advantage in that the units of carbon reduced by forest expansion would be the highest for a permit price; it involves lowest marginal costs involved and firms would find it profitable to reduce emissions so long as the costs of that option are lower than the cost of purchasing a permit. Mitigation strategies could extend to finding proper energy solutions for a low-carbon energy economy, explore options to leap-frog to cleaner development paths and work towards enhancing de-carbonizing potential. Under forest sector, adaptation may have to be explored in the following sectors :

- Water resource management and soil and water conservation – a shift to watershed approach, shift in priority from trees to water (emphasis on ecosystems and eco-services);
- Development of drought resistant varieties;
- Mixed cropping (agro-forestry, silvo-pastoral, emphasis to fruit bearing trees);
- Shift in forest management – longer rotation, landscape planting, 3-dimensional forestry, anticipatory planting, biodiversity conservation – propagation of medicinal plants, emphasis on species that increase carbon sequestration;
- Disaster management – protecting flood plains,
- Fire protection & infrastructure development.

Emission reduction : For Himachal Pradesh the momentum towards emission reduction and providing of compensation (payments for ecological services), such as tradable credits, through reduced deforestation and degradation holds promise. Reduced Emissions due to Avoided Deforestation & Degradation (REDD) would be advantageous for the mountain state. Himachal needs to examine various market strategies – pollution taxes and transferable/tradable permits.

To be effective, the H.P. Forest Department must take three important steps :

- (1) Recognize the value of ecosystems and environmental services to halt any further decline in the natural capital stock, especially where it concerns life support systems such as water;
- (2) Develop market mechanisms and incentives that promote future development of eco-services;
- (3) Create a more collaborative decision-making process that recognizes the rights of a variety of stakeholders to participate in decision-making, whether it is NGOs, villages, academia, other public agencies or the private sector.

Incorporating climate concern in long-term forest policy-making

The thinking that has taken root is to incorporate climate concern in long-term forest policy-making. Effective forest management practices and policies are to be developed as well as understanding the inter-relations between communities, government and the private sector (and forestry products). Himachal needs to protect its environment (for both local and

global reasons), create local jobs and adopt a sustainable development path and be a model for India and the world. Rabindranath (2008) states that HP has more than 1.0 million ha of waste lands (excluding Kinnaur and Lahaul & Spiti Districts) and with planting possible in around 83,000 ha, at a productivity 8 t Carbon/ha/yr, would make the State C-neutral.

As per the National Forest Policy 1988, one of the principal aims was to ensure environmental stability and ecological balance. The Government of Himachal Pradesh Forest Sector Policy and Strategy 2005, applicable to the HP Forest Department, carried the vision forward – “Area under forest and tree cover will be expanded through systematic planning and implementation of afforestation and rehabilitation program in degraded and open forests and available non forest lands. Regeneration of felled areas will be ensured in a time bound manner and productivity of plantations will be increased through use of improved seeds and planting stock. Monoculture, especially of Chir Pine will be discouraged and mixed plantations of broad-leaved fodder, fuel wood and wild fruit species will be promoted. Wherever feasible, plantations would follow the multi-tier and multiple use afforestation and rehabilitation strategy”. The National Forestry Policy has a mandate, that in hilly States, 66% of the geographical area needs to be brought under forest cover. In Himachal Pradesh, the legally classified forest area is 37,033 km², which is 66% of the geographical area (55,673 km²). The total legally classified forest area that cannot sustain tree crops/is uncultivable is 20,020 km² (19,020 km² is above 4,000 m and another 1,000 km² below 4,000 m, comes under nallahs/streams and cannot

sustain tree crops). Thus, the legally classified forest area that can sustain tree crops is merely, 17,013 km²! Area under horticulture is 2,230 km² and the land area under miscellaneous tree crops included in agriculture is 568 km². Thus the total area which is supporting or can support tree crops over Forest, Agriculture and Horticulture is only 35.5 % of the total geographical area of the state (Source: HP Forest Department Statistics 2000; HP Crop Report 2001-02; Statistical Outline HP 2002-03). The per capita availability of forests in Himachal is 0.22 ha against the national average of 0.06 ha. According to the reports of Forest Survey of India, Himachal Pradesh during the last few years has registered an increase of 1,859 km² in the forest cover. This increase is about 9% of the culturable forest area of the State. A small state like Himachal, which has only 1.7% of the geographical area of the country, has contributed a remarkable 4.5% of the net increase in the forest cover of the country. The policy requirement places demand for additional areas to be brought under tree cover, whereas the total culturable area that is available under recorded forests is 17,013 km². There are areas like permanent pastures, which cannot support tree cover and grass is the best vegetation that can grow there. In the current scenario, there seems to be no other way out, except to consider the un-culturable areas forming vital eco-systems and wildlife habitats also as part of forest/tree cover although it is agreed that for carbon sequestration purposes, tree cover is the best answer.

Any forest policy needs to consider maintaining eco-systems and habitats as well instead of giving emphasis on tree/forest cover alone – the alpine pastures come under the climax vegetation! The

area under tree cover can be further expanded only through regular afforestation and tree plantation activities of appropriate species in wastelands, degraded forest areas marginal and private lands. It may be noted that the classification by vegetation and ecological types has been done for scientific management of forests, mainly for silvicultural (revenue generation) purposes. The legal categorization into *Reserved Forests*, *Demarcated Protected Forests* and *Unclassed Forests* had a basis on the degree of governmental control over forest lands through legal and institutional mechanisms. However, in the changed context for meeting environmental needs, forests are to be managed as ecosystems for which fundamental classification of forests and their management is important in the context of this policy to promote appropriate land use, for increased productivity, providing enhanced livelihood opportunities and for improved ecosystem services to the society. Sustainable forest management represents a new look at forests and forest management to meet the major commitment of protecting and restoring the forest ecosystem—improve biological diversity, enhance water supplies, make possible carbon sequestration, meet recreation needs and provide for the forest dependent communities through improved non-wood forest produce.

New Himachal Pradesh Forest Policy 2005

The new Himachal Pradesh Forest Policy of 2005 states “sustainable forest management” as its chief goal and lists the following principles as its priorities: sustainable development, integration of natural resource management,

decentralized governance, gender equity, and that forest policy should be more of a process – enabling it to be reviewed, adapted and revised as needed. In its objectives the policy lists the following :

- Conserving and improving the natural resource base (faunal, floral and biodiversity) through effective management based on watershed principles.
- Conservation and management through sustainability and good forest practices – economically, socially and environmentally.
- Providing livelihood security to the forest dependent poor through forest goods and services.
- Participatory approach involving integration and involvement of all stakeholders.
- Meeting forest sector national obligations with regard to policies, laws, international agreements and covenants.
- Forest sector capacity building through research, training, extension, education and awareness.
- Adaptability, monitoring, review, and revision as needed.
- Appropriate land use.

Increased afforestation is also propounded by the National Mission for a Green India which has asked the State to enhance afforestation on degraded forest lands, direct action by communities through Joint Forest Management and for

an initial corpus through the Compensatory Afforestation Management and Planning Authority.

(A) *Sustaining the Himalayan (Mountain) Ecosystem in consonance with the National Mission for Sustaining the Himalayan Ecosystem*

1. *Promotion of community-based management in these eco-systems through incentives to community organizations and panchayats for protection and enhancement of forested lands. Payments for environmental services are to be explored :* Ecosystem services, human welfare and economic systems are intrinsically connected. Any sustainable development project must involve the community for it to succeed and the project design and trade-offs between different ecosystem services affect results. Compensating the poor for the lost economic opportunities, motivating increased conservation investments (modified farm productivity to regulate water quality) through payments go a long way to preserve local ecosystems and eco-services. The promotion of eco-tourism in Himachal Pradesh is in the spotlight to ensure that developing booming tourism in the state is environmentally benign, decentralized and that its benefits are equitably distributed – particularly to local rural households. The Government's intent has come through clearly through its revised HP Ecotourism Policy (2005), and the institution to make it possible stands instituted – HP Ecotourism Society has been formed in 2006, to be made operative through facilitation in the HP Forest Department. The basis is that 66% of the geographical area of the state is under forests. The policy attempts to open up the heritage – colonial period built, forest rest houses – to the discerning tourists, to

inculcate appreciation of nature through strict adherence to the concept of carrying capacity and sustainable development of the area. There is much to explore in Himachal under ecotourism designations – natural historical areas, indigenous cultures, fauna and flora. However many of these areas are relatively undeveloped and fragile, requiring an attitude in the spirit of conservation, appreciation, participation and sensitivity – low impact, non-consumptive and locally oriented, without disturbing the integrity and identity of the eco-system. Mapping and documentation are important.

2. *Adopting appropriate land-use planning and water-shed management practices for sustainable development of mountain eco-systems :* Plant species with better water and nitrogen use efficiency. Primacy has to shift to water as a priority in Himachal. A watershed is a complete unit – promoting integrated watershed development is a key to prevent further ecological imbalance. Looking at the forest landscape in terms of functionality rather than along boundaries would help. Thrust must now shift to growing of broad-leaved species suitable for soil and water conservation, fuel, fodder, fruit etc. Effective participation is essential – Women folk in the hills are quite active and aware of environmental conservation, and, therefore, the Mahila Mandals and Women Self-help Groups need to be actively associated in this drive.

3. *Maintain two-thirds of the mountainous area under forest cover, to prevent erosion and land degradation and ensure the stability of the fragile eco-system :* The target of 66% forest and tree cover, in the hills reflects the tree component without accounting for other vibrant non-tree

natural biomes like grasslands. The amendment of the target of the 1952 policy, of one-third area under forests, to forest/tree cover resulted in a shift of focus from ecological habitats to tree cover. Further, recognition of biodiversity characteristics and ecological services rendered by habitats like grasslands, natural desert ecosystems, alpine, and riparian habitats suggests that several biomes, even if devoid of tree component, can be recognized as 'green cover' and accounted so. Recognizing these facts, the following strategic principle will be adopted for dealing with the green cover (Planning Commission, 2006) :

(B) *Greening Himachal : In consonance with the National Mission for a Green India*

1. *Forests as carbon sinks* : Degraded forest land would be landscaped through direct action by communities, organized through joint forest management communities and guided by the HPFD. Capacity build-up is required on silvicultural practices for fast-growing and climate-hardy tree species. There is a growing realization that in addition to conventional approaches to the sustainable management and conservation of forests, to minimize further loss of the resource, restoring degraded lands at the landscape level is also necessary to guarantee a healthy, productive and biologically rich forest area for the long term – this concept is a complement to the management and protection of forest resources. Although it is not a new idea, its novelty lies in addressing and balancing trade-offs at the landscape level, and its pragmatic rejection of the insistence to return modified forest landscapes to their original pristine state. Forest landscape restoration is carried out under the assumption that improving the flow of

forest goods and services requires balancing livelihoods with protecting nature, and that this is best achieved within dynamic, multifunctional landscapes. The carbon market strategy holds promise. The planting of under-producing lands means carbon offsets, revenue for environmental projects, a financial incentive for growing trees, and managing forests for the full suite of environmental, social and economic benefits. The landscape approach to handling degraded forest areas is gaining ground as it is dynamic, multifunctional, multi-use, productive, healthy and sustainable. The National mission for a Green India holds promise and scaling up of planting especially in degraded area through funds that would be made available under the Compensatory Afforestation Management and Planning Authority (CAMPA) which would commence soon. In the present, carbon credits from forestry activities under the clean development mechanism (CDM) remain limited to afforestation and reforestation projects (UNFCCC - 2001). Post-Kyoto momentum (after 2012) towards emission reduction and providing of compensation (payments for ecological services), such as tradable credits, through reduced deforestation and degradation would be most advantageous for Himachal. The Payment for Ecosystem Services (PES) is a generic term for a variety of arrangements in which the beneficiary of ecosystem services pays back to the provider. In this study, PES is defined as "a voluntary transaction where at least one buyer makes a payment to at least one provider (seller), conditional on the provision of a well-defined, continuously provided ecosystem service or an ecosystem use likely to secure that service". PES models need to be developed in Himachal

to ensure success of our plantation program, soil and water conservation schemes, biodiversity endeavors and other community involvement packages.

2. *Enhance public and private investments for raising plantations for enhancing the cover and the density of forests* : Planting strategy for the future has taken following facts under consideration :

- (i) The area under 10% to 40% cover density (3,931 km²) requires density improvement through enrichment planting; the scrub areas (566 km²) need to be converted into some useful tree cover; the areas below 10% density; about 6,300 km² are required to be afforested. Tall planting is also a viable proposition to improve survival.
- (ii) The village grazing lands and even the permanent pastures require improvements in terms of soil and moisture conservation and increase in the nutritious and palatable grass. Low altitude pastures are available for silvi-pastoral activities also. These grazing lands and pastures require frequent re-visiting at short intervals keeping in view the high grazing pressure.
- (iii) The choice of species to be planted in a forest will be guided by the management objectives. In community forests, the species for planting will be decided through a participatory approach.
- (iv) Mixed plantations of adaptable, economically useful species, including potential bio-fuel species will be promoted and where feasible multi-tier crops will be raised, to address livelihood concerns of the resource poor groups (Rabindranath and Joshi, 2006).
- (v) Exotic species of afforestation will be introduced only after extensive field trials.
- (vi) Effective measures to regenerate threatened and declining species such as oaks, chilgoza pine, yew, junipers and walnut will be taken.
- (vii) Live-hedges will be adopted along the periphery of plantations as an effective fencing measure.
- (viii) Reduce fragmentation of forests by provision of corridors for species migration, both fauna and flora.
- (ic) Plantations of wild fruit trees will be done to augment the good base to wild animals and birds (GoHP, 2005)

3. *Conserving biodiversity* : Conserving biodiversity especially in natural heritage sites, including sacred groves, protected areas and other biodiversity 'hotspots' is crucial for maintaining the resilience of ecosystems. *In-situ* and *ex-situ* conservation of genetic resources, especially of threatened flora and fauna is required. Forests do play an indispensable role in the preservation of ecological balance and maintenance of bio-diversity. Policy has shifted that an income-based to an asset-based approach is correct and that intact habitats rather than modified fare better in mitigating impact. The 'wild state' is seen as being far beneficial than an extraction-based human-dominated model. In Himachal Pradesh propagation of medicinal plants in forest areas through community participation is gaining ground. The current 'Jan Jan Van Sanjivani Abhiyan 2008' is a thrust in this direction. Under catchment treatment plans concentrated action is being laid to improve socio-economic aspects of the area. Medicinal plant propagation would go a long way to help community upliftment. Bio-diversity hot spots need to be identified

and *in-situ* and *ex-situ* conservation of genetic resources, especially of threatened flora and fauna would be beneficial.

(a) *Aromatic and medicinal plant propagation* : As per HP Governmental intention, 20% of the planting should of fruit trees while 30% of the planting should be medicinal plant type species. Under medicinal plant propagation, the prominent species (for higher areas) are Bankakri, Patish, Dhoop, Himalayan Blue Poppy, Karu, Nihani, Hathpanja. Medicinal plant propagation could be an excellent source of employment in Himachal Pradesh. The HP Forest Department must undertake the program in collaboration with NGOs and CBOs with special participation of marginalized poor, especially women, and provide forest land for such use to these groups under the Participatory Forest Management Rules 2001 of the Himachal Pradesh government.

(b) *Propagating agro-forestry* : There are various advantages of using various agro-forestry practices, with benefits accruing to farmers and society. More research is needed to quantify returns fully, to promote its wider use and to assess the effects and trade-offs of different policies. Determining which practices are most suited to women and poor people needs greater attention as does finding ways to replicate successful interventions on a larger scale to reach more households. Silvo-pastoral models have been tried and found quite appropriate, both to improve vegetation and also to meet the demand of cattle, whose population in Himachal is comparable to the human population. The following points need to be kept in focus :

(i) Planting of leguminous/non-

leguminous trees in community/private lands.

(ii) Planting of green tufts on contours/underneath bunds.

(iii) Improve fodder quality – combine and work with different mixtures, leguminous fodder trees, non-leguminous trees, cultivated grass species (*Napier*, *Seteria*, *Penicum* etc.) and forage legumes (e.g. *Flemegia*, *Styloxanthus* – ideal for river bed sides for forage legume or stylo species-good forage as it remains green even in December).

(iv) Tree combination is to be balanced in a way that leaf fodder is available around the year (*Morus alba* 20%, *Leucaena* spp. 15% to be managed in bush form and flowering should not be allowed uncontrolled, *Bauhinia variegata* 20%, *Artocarpus* spp. 10%, *Terminalia* spp. 10%, *Acacia catechu* 10% and other 15% comprising of *Emblca officinalis*, *Zizyphus* spp., *Ficus* spp., *Celtis australis*, *Robinia* spp. and bamboo, etc.).

(v) Live hedges be planted in routine and supplemented with economic plants like *Abrus*, *Mucuna*, *Bauhinia vahilii*, *Asparagus*, *Celastrus*, *Zizyphus* spp. Rain-fed agro-horticulture fodder model can attract the following fruits to be tried – pear, plum, grafted ber, grafted amla, pomegranate, citrus and grafted mango.

3. *Bio-security and invasive forest tree species* : Concern over the potentially negative impact of the introduction of new species, breeding and genetic modification has increased attention on the need to develop regulatory frameworks and policies to manage risks. Introduced forest tree species can help sustain national and local economies and be of significant

value to the environment and to the society. However, when insufficient consideration is given, prior to use and when, on-site management is neglected, some species may invade adjacent areas, giving rise to a number of problems. Moreover, with global trade increasing, greater movement of people and overstretched quarantine services, the number of accidental introductions is expected to grow. Reliable information and better knowledge of economic and environmental effects are critically important for evaluating risks. Weeds infesting Himachal are *Ageratum*, *Parthenium*, *Solanum torvum* and *Lantana*.

(C) Strategic Research : In consonance with the National Mission on strategic knowledge for climate change

1. *Identify challenges and responses to climate change through funding high quality and focused research* : Identify and develop thermal resistant tree species capable of withstanding extremes of weather, long dry spells, flooding and variable moisture availability. Research programmes covering all important aspects of forest plantations including tree improvement, provenance trials, growth and yield tables and end use will be planned and implemented (GoHP, 2005). A district level assessment of climate change is required to measure changes in temperature, rainfall, floods, droughts, etc. and assessment of Impact (region specific) on water flow, glaciers recession, forests; biodiversity, biomass growth. There is need to develop adaptation practices and strategies and launch pilot projects. It would also help to

explore funding from International Agencies; funds can be obtained under National Climate Change Action Plan (Anon., 2008).

2. *Explore bio-fuel* : Biofuel production through energy crops (many grasses, agave), oilseeds, biomass, starch, algae and other sources can be explored. Initiatives can be undertaken to use Chir pine needles effectively and to reduce their fire hazard character.

3. *Convergence and integration of traditional knowledge and practice systems, information technology, geospatial technologies and biotechnology* : Creation of biodiversity registers for documenting genetic diversity and the associated traditional knowledge. Focus on remote-sensing and Geographic Information Systems would help – Satellite imagery and detection, spatial information and decision-support systems would have a lot of meaning especially when it comes to working out figures for avoided deforestation and degradation measurements.

4. *Modern nursery management practices* : Better and modern nursery management practices will be adopted to ensure the availability of quality planting stock.

5. *Forest fire management strategies* : This would be important for Himachal given the climate change warming that is coming about and the frequent fire damage occurrence in the Chil crop.

6. *Improved monitoring and evaluation* : Especially the need for ecological data at micro-level.

SUMMARY

Climate change may manifest significantly in Himachal Pradesh, with the impacts likely to adversely affect large percentage of the population depending on natural resources. A large scale shifting of forest biomes is being indicated. Himachal has to think of enough mitigation to avoid the unmanageable and enough adaptation to manage the unavoidable. Market strategies need to be examined and preparations are required to handle various options that come up with the new thinking under reduced emissions due to avoided deforestation and degradation (REDD). The sustainable forest management route taken by Himachal Pradesh promises a way out.

Key words : Climate change, Adaptation, Mitigation, Impact, Forest biomes, Reforestation, Deforestation, Afforestation, REDD, CDM, Market strategies, Himachal Pradesh, India.

जलवायु परिवर्तन से पड़ता प्रभाव और हिमाचल प्रदेश की वानिकी कार्य योजना
जसजीत सिंह वालिया
सारांश

जलवायु में होने वाले परिवर्तनों का हिमाचल प्रदेश में काफी ज्यादा प्रभाव पड़ता दिखाई पड़ेगा जिनसे प्राकृतिक संसाधनों पर निर्भर रहते लोगों का काफी अधिक प्रतिशत कुप्रभावित होगा। यह बताया गया है कि उससे काफी अधिक परिमाण से वनों का जीवसमुदाय स्थानविचलित होगा और हिमाचल को इस अपरिहार्य स्थिति का प्रबन्ध करने के लिए इस अप्रबन्धीय स्थिति और काफी अनुकूलनता को टालने में इसे काफी घटाने के उपाय सोचने ही होंगे। बाजार समरनीतियों को जांचने पड़तालने की आवश्यकता है तथा निर्वनन और व्याह्रास रोकें जाने से कम मात्रा में उत्सर्जन होने से नई सोच से जो विविध विकल्प सामने आएं, उनसे निपटने की तैयारी भी करनी होगी। हिमाचल प्रदेश ने टिकाऊ वन प्रबन्धन का जो मार्ग पकड़ा है उसी से इस स्थिति से निकलने का रास्ता दिखाई देता है।

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