

AGENDA FOR CLIMATE ACTION

FORESTRY

Linking the Vulnerability and Risk Assessment for
Uttarakhand with policy implications for the state



STATE CLIMATE CHANGE CENTRE, UTTARAKHAND FOREST DEPARTMENT, GOVERNMENT OF UTTARAKHAND.



1. OVERVIEW OF FORESTRY SECTOR IN UTTARAKHAND

Uttarakhand is a state that prides itself on its abundant forest cover. According to the latest Forest Survey of India (FSI), 46% of the State's geographical area is under forest and tree cover, nearly twice the national average of 24%.ⁱ The State is home to over 4500 species of flowering plants, 93 of which are endemic to Uttarakhand.ⁱⁱ The forests are largely concentrated in the middle transects of the State. In the last decade, while scrub, open forests, and medium dense forests have marginally declined (in the more rapidly urbanising districts), dense forests have seen a marginal improvement.ⁱⁱⁱ The FSI notes that the forest and tree cover in the State decreased by 1% between 2013 and 2015 owing to "rotational felling, and diversion of forest land for developmental activities."^{iv}

A large number of villages in Uttarakhand fall within forests or are located at the edge of forests. They are dependent on forest produce for their livelihoods through fuel wood, fodder and non-forest timber produce (NTFP), specifically medicinal and aromatic plants. Their collection, usage, and sale is directly linked to the livelihood of forest dependent communities, especially women.

Box 1: Observed trends linked to forest sector vulnerability

Based on Participatory Rural Appraisals (PRAs) of five sample villages in Uttarakhand

- Villagers are increasingly collecting fodder and fire wood from the forest because of rising demand as well as the use of mechanised agriculture which leaves little crop residue
- Villagers are venturing further into the forests to collect fodder and fire wood
- Villages, specifically women, tend to spend two to six hours every day collecting fodder and fire wood
- Only some villages (1 out of 5 in the sample) earn revenue from the sale of NTFPs

Uttarakhand has been one of the earliest adopters of community-based forestry through the formation of forest councils or Van Panchayats which oversee the management, usage, and protection of government-leased protected forests under the jurisdiction of the Revenue Department. However, the Uttarakhand Development Report (2009) notes that there have been institutional and employment generation issues with the village forest management committees, which are meant to help facilitate micro-financing and management of forest-based economic activities. Under-utilised funds, failure to submit utilisation certificates, in-fighting between villagers, and lack of adequate training processes are cited as reasons for their poor-functioning.^v

2. CLIMATE VULNERABILITY OF THE FORESTRY SECTOR IN UTTARAKHAND

The Government of India's National Mission for a Green India or simply, Green India mission (GIM) notes that climate change could cause "altitudinal and latitudinal"^{vi} shifts in the species of forest ecosystems and potentially increase the incidence of fires, pests, diseases, and invasive plant species. Climate change could in turn alter forest types, increase dieback (slow death of a forest type over time) and cause losses in floral biodiversity. A significant fallout of this would be a reduction in forest-dependant livelihoods, especially for women who depend on fodder, food, and fuel from these forests.

The Vulnerability and Risk Assessment (VRA) study for Uttarakhand specifically projects two impacts in the State's forests as a result of climate variability and change:

- Changes in forest types and their range
- Changes in net primary productivity (NPP) impacting the amount of biomass produced

2.1. Changes in forest types and their range

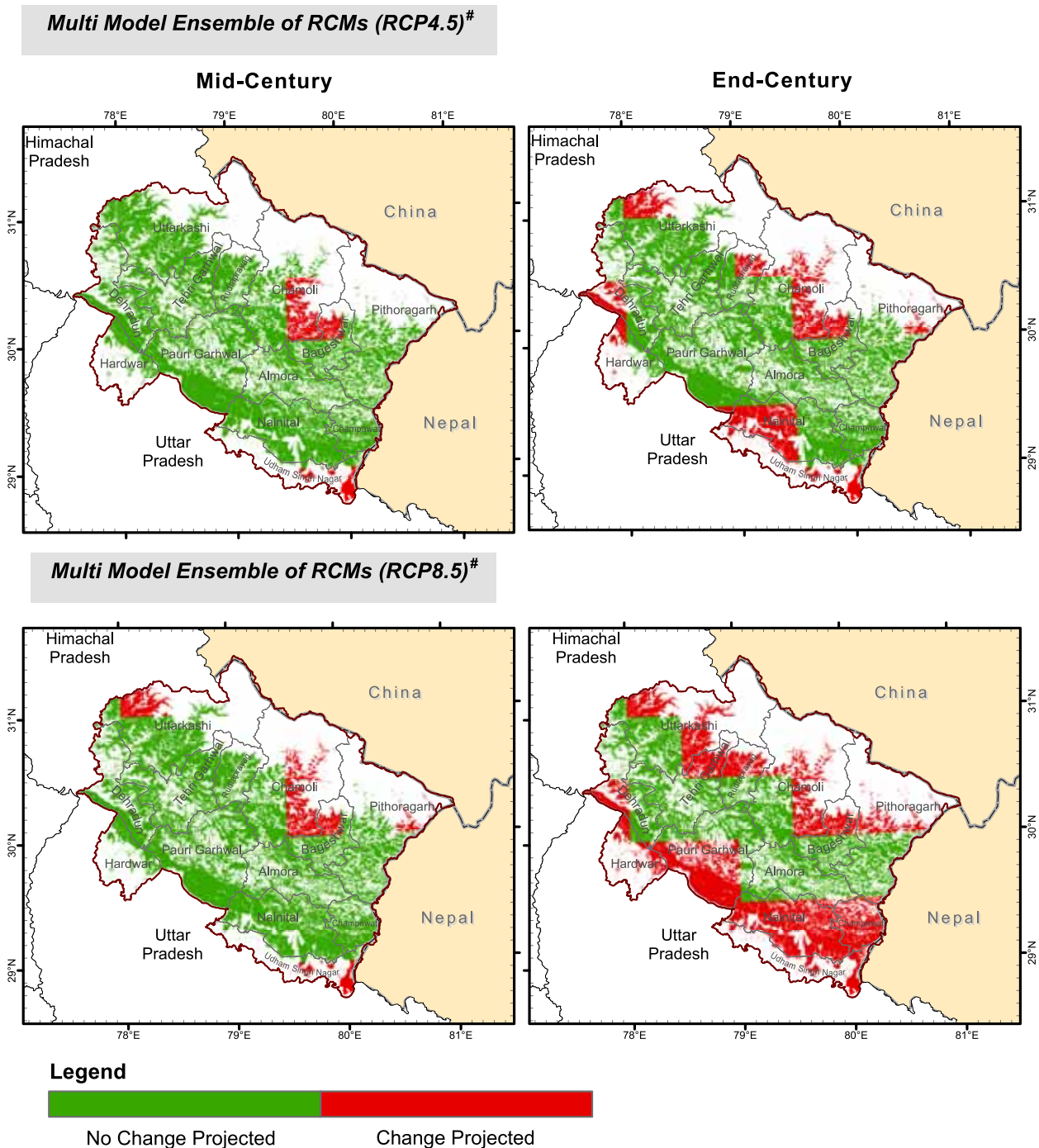
Based on model simulations, many plant species are likely to migrate to the upper reaches of the state with increased warming. In the mid-century, i.e. the next 35 years, anywhere between 7 to 17% of the forest grids are projected to see shifts in forest type or become unsuitable for existing vegetation under both scenarios (RCP 4.5 and

8.5)¹. In absolute terms, even a fraction of this shift may result in significant vegetation changes on the ground. During this period, parts of districts of Udham Singh Nagar, Bageshwar, Chamoli, Uttarkashi and Pithoragarh are likely to experience changes in vegetation (see Figure 1).

outer edges of the forest in the State – where the plains link to the hills and the inner-Himalaya links to the Kumaun Himalayas – may see vegetation shifting upwards owing to increased temperatures. Parts of Udham Singh Nagar, Nainital, Haridwar, Dehradun, Rudraprayag, Bageshwar, Chamoli, and Uttarkashi may experience vegetation shifts (See Figure 10).

By the end century, i.e. in 65 years, 37 to 62% of the forest grids may witness shifts in forest types. Districts along the

Figure 1: Map of model simulated changes in vegetation distribution in the forests of Uttarakhand



Analysis & Layouts prepared by Indian Institute of Science, Bangalore

¹ Representative Concentration Pathways (RCP) scenarios are greenhouse gas concentration trajectories adopted by the Intergovernmental Panel on Climate Change (IPCC) to describe four possible climate futures, depending on how much greenhouse gases are emitted in the years to come. In RCP 4.5 emissions peak around 2040, then decline. In RCP 8.5, emissions continue to rise throughout the 21st century.

Changes in vegetation types in Uttarakhand have two fallouts: First, the VRA notes that projected forest grid changes can particularly exacerbate the vulnerability of fragmented and disturbed forests. In such forest patches, seed dispersal typically gets impacted because of the loss or reduction in the number of sources and dispersal agents as a result of forest fragmentation and land-use changes. Second, beyond a certain altitude, alpine vegetation is unable to shift upwards to the colder desert regions. Even if temperatures increase as a result of climate variability, precipitation, terrain, and soil conditions may not be suitable for vegetation growth.

2.2. Changes in productivity

Production of biomass is seen as one of the key indicators of the health of forest vegetation. Increase in biomass productivity can result in the increased supply of forest products such as timber, fuelwood and other NTFPs. However, increased concentrations of carbon-dioxide in the atmosphere as a result of climate change, as well as climate variability in the form of projected increase in humidity, can impact forest biomass productivity in complex ways.

In Uttarakhand, Net Primary Productivity (NPP) which is one of the indicators (along with other factors) of biomass productivity is currently higher in forests in the southern regions of Udham Singh Nagar, Nainital and Champawat, and lowest in the upper altitude districts of Uttarkashi, Rudrapur and Chamoli.

According to the VRA, NPP – and linked to that biomass and soil carbon – are projected to improve in the mid and end-centuries (under both scenarios) because of increased precipitation as well as higher CO₂ fertilisation (indicating larger amounts of carbon dioxide in the atmosphere for plant growth).

However, it is worth noting that long-term vegetation shifts (as noted above) as well as other climate induced factors lend a considerable degree of uncertainty to the productivity of various species. Scientists suggest that improvements in biomass productivity would therefore be more likely in short-rotation tree species such as eucalyptus, pine, poplar, willows etc., with the potential to improve the income and livelihoods of forest communities and women through agro forestry initiatives.^{vii}

Moreover, in the long term, the VRA notes that the impact of CO₂ could be more detrimental to forests. The projected increase in NPP may be off-set by other phenological factors (linked to a plant's life cycle) such as heterotrophic respiration (carbon being released into the atmosphere) leading to a possible decline in net ecosystem productivity by the end-century.

3. LIMITATIONS OF THE VRA

Increase in pests and diseases as well as increase in forest fires are noted as common impacts of climate change in the forest sector. The VRA, however, does not specifically account for these; nor does it make any assumptions about the specific nature of floral biodiversity loss. The VRA states that the models used do not take into account the behaviour of individual species, and have simplified representations of dynamic disturbances like fires. The VRA will therefore need to be supplemented with on-ground studies to further assess the likelihood of pests and forest fires. Finally, model-based projections of NPP of forests are highly uncertain and do not always give a precise indication of the impact of climate change on biomass productivity.

4. ON-GROUND VULNERABILITY AND COPING STRATEGIES

“Local communities look for financial incentives for conducting any forest management activity. Till the project runs, they contribute. Making it sustainable in the longer term is the challenge.”

- Climate Action Group, SCCC²

² The SCCC or the State Climate Change Centre is a semi-autonomous body led by the Uttarakhand Forest Department. The Climate Action Group is a cross-sectoral group of department officials meant to contribute to the climate agenda in the state through coordination and interaction with the SCCC.

The PRA analysis indicates a number of livelihood related vulnerabilities linked to the forest sector in villages (See Box 1). In villages such as Majuli (Nainital) and Chameli (Tehri Garwal), residents collect more fodder from forests as new farming techniques have reduced the availability of agricultural residue for fodder. In addition, firewood is the primary option for cooking fuel in many villages as echoed by people in Kantari (Uttarkashi) and most of the firewood is collected from the Van Panchayat. Across villages, women typically spend anywhere between two to six hours a day collecting firewood and fodder across seasons. While four out of the five villages studied, have Van panchayats, only in Majuli did villagers specifically refer to the sale of forest produce. In light of these observed trends, strengthening programs linked to improving the availability and market access of NTFPs is critical as well as initiatives to diversify livelihood options. The availability of government schemes and programs can help in diversifying livelihood options. A focus on improving the governance of Van Panchayats can contribute to community based conservation efforts. This will also ensure that fodder and fuelwood collection is not further fragmenting vulnerable forests.

5. CLIMATE AND FOREST POLICY LANDSCAPE

The key document linked to climate change and the forestry sector in Uttarakhand is the Uttarakhand Action Plan on Climate Change (UAPCC).^{viii}

Nationally, the sector is guided by the Green India Mission (GIM), one of the eight missions under the National Action Plan on Climate Change (NAPCC).^{ix} The forest department in Uttarakhand has constituted a Green India Mission Cell and according to the UAPCC, a 10-year perspective plan is being finalised under the mission.^x Specific projects under the GIM mission cell such as the National Bank for Agriculture and Rural Development (NABARD) funded study on examining the potential for forest and tree cover in peri-urban parts of Uttarakhand have also been initiated.^{xi}

The National Mission on Sustaining the Himalayan Ecosystem^{xii} is another mission document pertaining to climate change and the forestry sector in the State.

Forest policies and plans in Uttarakhand should be reviewed

in light of the VRA, in order to manage areas of current and emerging risk due to climate change. At present, there is no up-to-date overarching forest policy document specific to Uttarakhand. The lack of such a document can hinder efforts at climate compatible forest development in the State. Moreover, climate resilient practices can make a significant difference to the livelihood and adaptive capacity of women. The Forest working plan for 2014-2015 makes a brief mention of climate change in its preamble.^{xiii} Existing forest policies and schemes at the national and state level that need to be reviewed and potentially aggregated in light of the VRA are:

- Annual forest working plan
- Uttarakhand Van Panchayat Rules (2005)
- Five-year micro-plans of van panchayats, specifically in the blocks and districts highlighted by the VRA
- GIM's ten-year perspective plan for Uttarakhand
- Ten-year management plans of the Forest Development Corporation
- Uttarakhand's five-year Plan

A review of the State's forest policy to incorporate climate resilience is in line with India's Nationally Determined Contributions (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC) which reiterates the Green India Mission's aim to further increase the forest and tree cover to five million hectares and improve the quality of the forest and tree cover to another five million hectares, along with providing livelihood support. Moreover, the NDC points to opportunities for additional revenue to states through a number of national schemes and programmes.

“Biodiversity Management Committees have been formed under the Uttarakhand Biodiversity Board (to preserve and promote local biodiversity and prepare People's Biodiversity Registers under Gram Sabhas)”

- Climate Action Group, SCCC

6. AGENDA FOR CLIMATE ACTION IN FORESTRY

The following table provides suggested areas of action to be undertaken in the forestry sector over the next five years based on findings of the top-down VRA, a bottom-up review of community trends, and a review of existing state and national priorities.

CLIMATE IMPACT AREA	ACTION	TYPE OF INTERVENTION
<p>Changes in forest types and their range</p>	<ul style="list-style-type: none"> Projected shifts in vegetation grids in fragmented forests can worsen land-slides owing to soil erosion. The projected impacts in the forest sector need to be aligned with the Uttarakhand State Disaster Management Plan. Examine the VRA findings in context of the State’s existing programmes to improve quality and density of degraded forests, with a special focus on fragmented forest areas. Attention to be paid to development activities in vulnerable areas, as noted in the Forest Survey of India (FSI), to stem the current rate of deforestation. Conservation measures with specific focus on existing biodiverse forests to curtail the rate of fragmentation. Reduced fragmentation in vulnerable corridors can also allow forest species to move upwards as temperatures rise. Regulate invasive species as weeds are expected to thrive under increased temperatures. 	<p>Policy review and mainstreaming</p> <p>Information and Research</p> <p>Strengthening existing programmes</p> <p>Strengthening existing programmes</p>
<p>Uncertainty in biomass availability</p>	<ul style="list-style-type: none"> Review and update the Uttarakhand Van Panchayat Rules (2005), to incorporate VRA findings and initiate further on-ground research on availability of NTFPs. Strengthen Van Panchayat governance systems through sustained incentive mechanisms to improve conservation measures and forest livelihoods to shield forest communities from significant projected variations in biomass productivity in mid and end-centuries. Improve mechanisms for better market access of NTFPs through the private sector. Appropriate measures to improve productivity and production of herbal and medicinal plants and their trade (as noted in UAPCC). Increased focus on short rotation forestry where biomass improvement expected to occur. This can also help improve livelihoods through targeted agro forestry programs. Link VRA findings with the work of over 700 biodiversity management committees which are led by the village Gram Sabhas. 	<p>Policy review and mainstreaming</p> <p>Strengthening existing programmes</p> <p>Strengthening existing programmes</p> <p>Strengthening existing programmes</p> <p>Policy review and mainstreaming</p> <p>Policy review and mainstreaming</p>

CLIMATE IMPACT AREA	ACTION	TYPE OF INTERVENTION
Increased risk of forest fires	<ul style="list-style-type: none"> Factor limitations in the VRA in assessing forest fires and initiate research on the topic as well as assess regulatory factors governing the management of these fires, given that the link between rising temperatures and worsening forest fires has been established by the Inter-governmental Panel on Climate Change (IPCC).^{xiv} 	Information and Research
Loss of floral biodiversity	<ul style="list-style-type: none"> Factor limitations in the VRA by initiating research on changes in specific floral species based on historical trends and areas where vegetation changes are projected. 	Information and Research
Climate change can undermine development objectives	<ul style="list-style-type: none"> Review the ten-year Forest Development Corporation management plan and ten-year Green India Mission perspective plan for Uttarakhand in line with VRA findings. Examine national-level policies such as National Agro-forestry Policy (NAP) and REDD-Plus (Reducing Emissions from Deforestation and forest Degradation) policy in light of the VRA findings.³ 	Policy review and mainstreaming Policy review and mainstreaming

7. DEVELOPMENT CO-BENEFITS

The suggested areas of climate action in would lead to the following development co-benefits:

- Assist in the delivery of Government of India's (GoI) Forest Policy (1988) aim to maintain two third of the area in hills and mountainous regions under forest cover to prevent erosion and land degradation to ensure the stability of fragile ecosystems.
- Help the State avail GoI's 14th Finance Commission incentive for creation of carbon sinks in which devolution of funds to states from the federal pool would be based on a formula that attaches 7.5 % weight to the area under forest cover.
- Benefit from the GoI's proposed devolution of around USD 6 billion under Compensatory Afforestation to states.
- Help fulfil GoI's Forest Policy (1988) objective to meet the fuelwood, fodder, minor forest produce, and small timber requirements of rural and tribal populations.
- Result in better employment and revenue for forest communities, especially women
- Generate revenue through the national REDD+ and Agro-forestry schemes outlined in India's NDC.

³ Rs. 13,000 Cr has been approved under GIM for all states for five years.

REFERENCES

- ⁱ Forest Survey of India (FSI), Ministry of Environment Forest and Climate Change (MoEFCC), Government of India (GoI), 2015. Forest and Tree Resources in States and Union Territories In: India State of Forest Report [online]. Dehradun: GoI. Available at: <http://fsi.nic.in/isfr-2015/isfr-2015-forest-and-tree-resources-in-states-and-union-territories.pdf>
- ⁱⁱ Integrated Natural Resource Management Consultants (INRM), Geo Climate Risk Solutions and Indian Institute of Science (IISc), 2016. Climate Change Risks and Opportunities in Uttarakhand, India: Technical Report on climate change impacts on select sectors. New Delhi: INRM.
- ⁱⁱⁱ Ibid
- ^{iv} Forest and Tree Resources in States and Union Territories, 2015.
- ^v Planning Commission (erstwhile), GoI, 2009. Uttarakhand Development Report [online]. New Delhi: GoI. Available at: http://planningcommission.gov.in/plans/stateplan/sdr/sdr_uttarakhand1909.pdf
- ^{vi} MoEFCC. GoI. National Mission for a Green India (under National Action Plan on Climate Change) [online]. New Delhi: GoI. Available at: http://www.moef.gov.in/sites/default/files/GIM_Mission%20Document-1.pdf
- ^{vii} Pers. comm., 2016. NH. Ravindranath, Professor, Centre for Sustainable Technologies, IISc. 9 September 2016, Dehradun.
- ^{viii} Government of Uttarakhand (GoU), 2014. Uttarakhand Action Plan on Climate Change (UAPCC) [online]. Dehradun: GoU. Available at: <http://www.moef.gov.in/sites/default/files/Uttarakhand%20SAPCC.pdf>
- ^{ix} GoI, National Mission for a Green India
- ^x UAPCC, 2014.
- ^{xi} Himalayan Institute for Environment, Ecology and Development (HIFEED), 2012. Preparation of Perspective Plans and Micro Plans under GIM Project [online]. Available at: <http://www.hifeed.org/index.php/projects-assignments/preparation-of-micro-plans-perspective-plans-dprs/preparation-of-perspective-plans-micro-plans-under-green-india-mission-project>
- ^{xii} Department of Science and Technology, GoI, 2010. National Mission for Sustaining the Himalayan Eco-System (under National Action Plan on Climate Change). New Delhi: GoI. Available at: http://www.dst.gov.in/sites/default/files/NMSHE_June_2010.pdf
- ^{xiii} Pers. comm., 2016. NH. Ravindranath, 9 September 2016, Dehradun.
- ^{xiv} IPCC, 2014. Summary for policymakers. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.



This document is an output from a project commissioned through the Climate and Development Knowledge Network (CDKN). CDKN is a programme funded by the UK Department for International Development (DFID) and the Netherlands Directorate-General for International Cooperation (DGIS) for the benefit of developing countries. The views expressed and information contained in it are not necessarily those of or endorsed by DFID, DGIS or the entities managing the delivery of the Climate and Development Knowledge Network, which can accept no responsibility or liability for such views, completeness or accuracy of the information or for any reliance placed on them.

AUTHORS: Anu Jogesh, Jennifer Steeves, and John Firth

Acclimatise Group Ltd | Hexgreave Hall, Farnsfield, Newark, Nottinghamshire, UK, NG22 8LS

Tel +44 1623 88437 | **Web** www.acclimatise.uk.com | **Twitter** <https://twitter.com/acclimatise>