Rainforestation (RF) Research Topic Recommendations:

I) Prof. Dr. Friedhelm Göltenboth of Hohenheim University:

- Studies on native tree performance under specific conditions and RF types
- Comparative studies of RF tree structure
- Spatial relationships in RF communities as indicated by growth performance
- Comparison of keystone trees in different RF sites
- Buffer zone interrelationships between natural forest areas and RF areas
- Pollinators of native rainforest trees
- Nutrient requirements of native tree seedlings
- Nutrient and water uptake of RF trees
- Light requirements of RF tree seedlings
- Recolonization studies of RF sites by indicator organisms
- Carbon sequestration abilities of native RF Trees
- Biodiversity studies on small mammals, amphibian, reptiles, insects in RF sites
- Studies on biomass breakdown in comparison between primary forest and RF forests of different type
- Studies on economical value of a standing native trees
- Studies on shade-tolerant crop plants for possible integration in RF sites

II) Dr. David Lamb, from *Regreening the Bare Hills: Tropical Forest Restoration in the Asia-Pacific Region* (Springer 2011)

Ten Ecological Questions

1. *How can reforestation programs make more use of indigenous tree species?*
A relatively small number of species are currently used in reforestation. What species will be attractive in future market places? How can seed of these species be collected and stored? Can they be easily grown in nurseries?

2. *What are the site preferences of these species?*
Conditions at many deforested sites are such that species that once grew there can no longer do so. Where can they be grown now? What is their productivity at these sites? Which species need some early shade (how much and for how long)? What are their nutritional requirements? Where should they not be grown?

3. *How can complementary species able to grow in multi-species plantations be identified?*
Mixed-species plantings have certain ecological and commercial advantages. But random assemblages of species will rarely be effective. Are there characteristics of species (shade tolerance? growth rate? crown architecture?) enabling judgments to be made about their likely complementarity with other species? What types of species might complement each other and which types will not?

4. *How much secondary forest is present in various ages or degradation classes?*
There are large areas of secondary forest in most countries within the Asia-Pacific region. These have resulted from regeneration after cleared land is abandoned or left after logging. How much of this forest is present across the

Asia-Pacific region in various age classes? What is the conservation status of these different types or age classes of forest? What is their like future commercial or conservation value?

5. *How well are different types of planted forests able to generate the ecosystem services previously supplied by natural forests?*
Not all planted forests are the same, especially in terms of their environmental impacts. How well are these different forests able to supply various ecosystem services including habitats for wildlife and watershed protection? How is this affected by the age of these forests or by their spatial distribution or their landscape context?
6. *What role might reforestation have in maintaining the populations of species usually found in forest interiors?*
Certain habitat specialists and top-order predators require large areas of relatively undisturbed forest. These species become increasingly vulnerable as natural forests shrink. What forms of reforestation might help conserve such species in the modified landscapes of the future?

7. *How does the type, scale and spatial arrangement of forest patches affect the ability of biota to persist and move across an otherwise agricultural landscape?*
Certain forest wildlife can move across heterogeneous landscapes containing at least some woody vegetation. Some can also reproduce in these landscapes away from natural forest. Which are these species and what types of forests and landscape patterns do they require? Which forest wildlife species will not persist or breed in such landscapes?

8. *How can tropical forests be ecologically restored?* Ecological Restoration might be an appropriate objective in some locations. How
can this be most effectively be carried out? What is the role of species with different functional traits? Does the assembly sequence matter or do alternative pathways eventually coalesce around a limited number of endpoints? What is the role of facilitators or framework species? Is it easier to restore the less-complex tropical forests found on isolated (Pacific) islands than more complex forests found on (Asian) mainlands?

9. *How to increase the ecological resilience of plantations at both local and landscape scales?*
There are guidelines for improving ecosystem resilience but not much experience in actually applying these to reforestation programs. How much functional redundancy should plantation managers build into their silvicultural designs or landscape mosaics? What trade-offs are needed to enhance economic resilience?

10. *What are the design principles for reforesting degraded landscape in the face of climate change?*
Planted forests have the capacity to sequester significant amounts of carbon and systems of payment are likely to become available to growers whose plantings provide this service. Which species should be used in particular locations? How can the sequestration of soil carbon be enhanced? Where should reforestation be carried out to maximise carbon sequestration? Where should it be done to enable tropical biota to adapt to climate change?

Ten Socio-Economic Questions

1. *What plantation designs might improve livelihoods as well as generate conservation benefits?*
Reforesting degraded land has the capacity to generate financial as well as conservation benefits. Some landowners are happy to choose just one of these but increasing numbers are interested in doing both. What are the trade-offs that must be made? How do these vary with forest age? How are these influenced by landscape context?

2. *How can secondary forests be managed to improve livelihoods as well as generate conservation benefits?*
Secondary forests are usually capable of restoring forest cover relatively cheaply. But many are cleared because they are thought to be valueless. What mechanisms or policy settings could help retain and protect secondary forests?

3. *How can farmers be helped to choose the most appropriate tree species and type of plantation to suite their circumstances*?
Many farmers prefer to use fast-growing exotic species such as *Eucalyptus* or *Acacia*. These may be the best choices in some situations but not others. How are farmers to make the most appropriate species choices to suit their circumstances?

4. *How can the spread of silvicultural information be hastened? How can research findings about conservation biology be implemented?*
Many farmers would carry out reforestation if they were more familiar with the technology. Managers of National Parks would also use more suitable forms of reforestation to rehabilitate degraded areas within their parks if they knew how to do so. How can existing knowledge be shared? How can it be communicated in a way that makes sense to the people who might use it?

5. *How can plantation owners maximize the benefits they receive from their investment?* How might they learn of market opportunities? How could they receive better prices for the products they sell?

6. *How can a system of payments for ecological services be established?* There is often an imbalance between providers and beneficiaries of the ecological services provided by reforestation. How might providers of ecological services be paid? What type of system is needed to avoid high transaction costs when there are many growers with small farms?

7. *How can more resilient forms of reforestation be promoted?* Farmers with low incomes are often attracted to simple types of reforestation involving species such as *Eucalyptus, Acacia* or teak. Such plantations are often very productive and financially rewarding. Why should they do anything else? What are the benefits to a single household of diversity or landscape heterogeneity? How can more resilient forms of reforestation be promoted?

8. *How can Forest Landscape Restoration be promoted?* Strategic interventions in the landscape mean reforestation activities are more

effective than random acts of tree planting. But what is the best way of coordinating forest landscape restoration? Should government agencies always have the coordinating role? How might private land owners be compensated for undertaking activities that primarily benefit the wider community?

9. *Whatrolemightdifferentformsofincentivesplayinencouragingreforestation and conservation practices by farmers?*
Reforestation may not always be an attractive land use practice and some farmers may need an incentive of some kind if they are to plant trees on their land or to use particular species or types of planting designs. What are the most cost-effective incentives (from a government viewpoint)? Are there alternative forms of financing that might make long-term crops like trees more attractive?

10. *How can social-ecological systems be helped to adapt to climate change?*
The effects of climate change will be widespread but the impacts at particular locations are still uncertain. What forms of ecological and socio-economic monitoring will be needed to enable land managers to adapt in a timely fashion? What are the key issues that they will need to take into account when making changes to the ways they manage their land and forest resources?