**Notes for the Slide Presentation "Climate Change and Biodiversity: Problems and Solutions" by Tom Lovejoy at ICCB Baltimore, 2013**

A talk about what climate change does to biodiversity and how biodiversity can help address part of the climate challenge

1. Planetary boundaries transgressed. Nitrogen about right. Climate Change underestimated because of the impact on biodiversity. Biodiversity the biggest excursion of all because it integrates all environmental problems.
2. When Arrhenius published his greenhouse effect paper in 1896 he was trying to answer the question: why is the Earth a habitable temperature for humans and other forms of life?
3. Arrhenius would not have been aware of the temperature of the previous hundred thousand years, and that, in particular, the climate of the last 10,000 years has proven to be unusually stable. In those 10,000 years all ecosystems have adapted to a stable climate.
4. The impact of climate change can be seen in the biology of the planet everywhere anyone looks. Plant and animal species are changing their life cycles
5. Species are changing where they live. The California Checkerspot butterfly has been moving northward and upward in altitude.
6. Species in high places like the pika are especially vulnerable. They will move upward tracking desired climate conditions until there is no further upward to go.
7. Island species, especially low lying island species, are especially vulnerable to sea level rise, but also to changing climatic conditions with no ability in the face of change to move and track desired conditions.
8. Science is also recording ecosystem scale changes; coniferous forests of western North America are now extremely vulnerable to native bark beetles because winters are milder and summers longer.
9. In the oceans tropical coral reefs are particularly vulnerable. Only short periods of warmer water cause the coral animal to eject its alga partner leading to bleaching events where diversity, productivity and human benefit crash.
10. There is major system change as well: uptake of CO2 by the oceans has led to increasing acidity. The oceans are now 0.1 pH unit more acid
11. A world with CO2 concentrations more than 350 ppm will be a world without tropical coral reefs.
12. Two degrees is therefore too much for ecosystems. In addition, the last time the world was two degrees warmer the oceans were four to six meters higher
13. Unfortunately if climate change is to stop at two degrees, global emissions have to peak in 2016
14. So what can be done? There are ways to revise conservation strategies to make biodiversity and ecosystems more resilient. The world energy base bas has to be drastically revised. And emissions from deforestation and destruction and degradation of other ecosystems should be reduced and then eliminated.
15. A significant amount of the excess atmospheric carbon comes from ecosystem destruction and degradation: 250 billion tons or more.
16. Some of that CO2 can be pulled back through ecosystem restoration at planetary scale. That could reduce climate change impact by half a degree C. The power of biology is considerable, but not enough (as emissions continue) so we need to find non-biological ways to supplement what ecosystem restoration can do.
17. This would involve reforestation and forest management to increase carbon content.
18. Restoring degraded grazing land could make a major contribution and provide better grazing
19. Agriculture should be modified to increase soil carbon rather than leak it. There is also potential in blue carbon (that which can be captured by restoring wetlands)
20. So the suggestion is to manage the Earth as a biophysical system, and to Re-green the Emerald Planet by using the living planet to make the Earth more habitable for humans and other forms of life.