Extreme resiliency?
Risk and reward in Central American coffee farming

PS Baker
www.cabi.org

KNOWLEDGE FOR LIFE
The thrust of this talk

- Central America is a climate change hot spot
- IPCC have just told us (new Appraisal Report 5) that future extent of change is highly uncertain (especially precipitation)
- Centam coffee farmers’ risk levels have risen massively over the past generation
- Support structures for farmers are weak
- Roya is a symptom of a large malaise
- Farmers are trapped – spend more to carry on with coffee
- Or change to what?
- Many farmers are only weakly resilient – how do we best help them?
It’s been getting hotter
IPCC AR5 WGI

- It will go on getting hotter
- Warm nights could have some bearing on roya
Precipitation – getting drier... maybe

JJAS
CMIP3 MME A1B (24)  CMIP5 MME RCP4.5 (39)  MRI–AGCM3.2H A1B (12)

DJFM
CMIP3 MME A1B (24)  CMIP5 MME RCP4.5 (39)  MRI–AGCM3.2H A1B (12)
Temperature and precipitation projections by the CMIP5 global models. The figures shown are averages over SREX regions (Seneviratne et al., 2012) of the projections by a set of 42 global models for the RCP4.5 scenario. The area mean temperature and precipitation responses are first averaged for each model over the 1986–2005 period from the 12 historical simulations and the 2016–2035, 2046–2065 and 2081–2100 periods of the RCP4.5 experiments. Based on the 13 difference between these two periods, the table shows the 25th, 50th and 75th percentiles, and the lowest and highest 14 response among the 42 models, for temperature in degrees Celsius and precipitation as a percent change.
IPCC folk say:

“Multi-model results for precipitation indicate a generally low predictability.” [IPCC AR5 WG1]

“We are unlikely to be able to make confident statements about circulation, hence about droughts, flooding, etc.” [Ted Shepherd, Grantham Professor of Climate Science, Reading University. Royal Society 3rd October 2013.]

It is likely warm-season precipitation will decrease in the Caribbean region, over the coming century. However, there is only medium confidence that Central America will experience a decrease in precipitation. [IPCC AR5 WG1]

Precipitation will likely be more extreme near the centres of tropical cyclones making landfall in North and Central America... [IPCC AR5 WG1]
Young scientists may retire before global climate models are good enough for agriculture

“Substantial increases in the reliability of projections from General Circulation Models (GCMs) are not expected any time soon”

Richard Washington, University of Oxford

GCM errors were often larger than 2 °C for temperature and 20 % for precipitation
Unresilient Centam – degraded soil hot spot

A THREATENED RESOURCE
In some places soil is being lost 100 times faster than it forms.

Very degraded soil
Stable soil
Degraded soil
Without vegetation
Unresilient Centam – modelling of agriculture & ecosystem change

Centam identified as an ‘area of overlapping or contiguous agricultural and ecosystem change that appear by 2050’
Project change in flood frequency. Multi-model median return period (years) in 21C for discharge corresponding to the 20C 100-year flood.
Unresilient Centam – increasingly violent weather

- Increasing frequency of short violent events – e.g. Central America

- Number of hurricanes and tropics storms has greatly increased in the past two decades
## Unresilient Centam – food production to 2050

Table 1  Changes in Total Calorie Production due to Climate Change, 2030 and 2050 (%)

<table>
<thead>
<tr>
<th>Region/Country</th>
<th>2030</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Global Medium scenario</td>
<td>Global Wet scenario</td>
</tr>
<tr>
<td>PRC</td>
<td>(3.0)</td>
<td>0.3</td>
</tr>
<tr>
<td>India</td>
<td>(1.3)</td>
<td>0.8</td>
</tr>
<tr>
<td>Japan</td>
<td>1.7</td>
<td>2.8</td>
</tr>
<tr>
<td>Republic of Korea</td>
<td>1.9</td>
<td>3.1</td>
</tr>
<tr>
<td>Mongolia</td>
<td>0.5</td>
<td>3.0</td>
</tr>
<tr>
<td>Latin America</td>
<td>0.8</td>
<td>1.6</td>
</tr>
<tr>
<td>North America</td>
<td>0.6</td>
<td>4.1</td>
</tr>
<tr>
<td>Russian Federation and Central Asia</td>
<td>(1.6)</td>
<td>3.7</td>
</tr>
<tr>
<td>Europe</td>
<td>2.0</td>
<td>3.8</td>
</tr>
<tr>
<td>Central America</td>
<td>(0.3)</td>
<td>(0.4)</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>(0.2)</td>
<td>(0.2)</td>
</tr>
<tr>
<td>Mediterranean countries</td>
<td>1.8</td>
<td>1.3</td>
</tr>
<tr>
<td>South Asia and Southeast Asia</td>
<td>0.3</td>
<td>0.4</td>
</tr>
<tr>
<td>Pacific</td>
<td>2.9</td>
<td>4.5</td>
</tr>
</tbody>
</table>
Centam is *climate change central*

- This is where it’s all kicking off
- Many signs that it the region is not ecologically & climatically resilient
- Extreme and unpredictable weather
- Models can only give very rough idea of what is going to come
- **Direct effects on coffee growing**: heat & ppt (flowering etc.)
- **Indirect effects**: pests and diseases, declining infrastructure (roads)

Authentic farmer quote:
- *We’ve always had extremes of weather, but now they’re more frequent and the land is not getting enough time in between weather events to recover.* [Farmer, E Midlands. England Climate E Midlands Soil Management Workshops, August 2013]*
To be a bit provocative:
It’s not really about roya!

- We can fix roya – that’s not the real problem
- (well ... it is a problem if you can’t pay for it and if everyone is expecting a simple fix)
- Roya is just one manifestation of a much bigger problem
- Think of it as the earthquake that reveals the fault-line
- Centam farmers have been sitting on top of an increasing mountain of risk
- We can control roya but we can’t control:
  - Markets (prices)
  - Climate change
  - Population change, expansion
  - Environmental degradation
- We can’t control these, so we have to learn how to cope, adapt and transform to live with them
- That is what resilience is about
Coffee farmers and risk
Climbing a wall of risk & uncertainty

- 50 years ago:
  - No roya
  - No broca
  - Global production quotas = price controls
  - Low wage costs
- Farming wasn’t easy, but if prices dropped/bad weather, you could neglect your coffee and it would still yield something
- As conditions improved, you could improve fertilization, weeding etc.
- The perfect crop for smallholders – a living ATM, which occasionally coughed up a bonanza
- Uncertainty was fairly low – risk (low prices, occasional bad weather) was factored into the business model
Now it’s different

- It’s all been creeping up on us - higher and higher costs
- Now the farmer can’t leave the crop to fend for itself:
- Roya and broca will take it away
- The farmer is on a treadmill: work harder to produce more to pay for higher costs
- The hard truth for those of us trying to help farmers:
  - We keep approaching them to tell them to do more
  - We are not making life easier for them
- What seems to be happening at the moment is that we want to apply a band-aid and carry on as before
- Is that what resiliency is about??
It’s not just the climate that has changed

- It’s the political and economic climate too
- No price controls, unpredictable price scenario
- Little/no government support (city vs. countryside)
- Increasing insecurity
- Insufficient investment in research and extension
- This was a conclusion of the rust summit in Guatemala in April
An unfortunate moment in history?

- There are increasing climate-related production problems in some countries,
- But unequal distribution of problems (Brazil, Vietnam less affected)
- Exploitative laissez-faire attitude in other countries leads to deforestation and production increase
- Free-market philosophy reigns (no supply or price controls)
- What this all means is that when risks rise in some countries (e.g. CentAm, Colombia etc.), prices do not compensate
- Farmers are therefore in a very risky/uncertain situation
The three pillars – an outmoded concept of sustainability?

But the three pillars are not homologous
Better concept? Need resilience of all

Coffee ecosystem

Coffee community

Biosphere system

Coffee business
Extreme resiliency?

- You need a measure of resiliency and stability for:
  - **Biosphere** (global climate)
  - **Coffee ecosystem** (e.g. water, nitrogen, waste cycles)
  - **Social system** (esp. security, infrastructure, services)
  - **Coffee business** (esp. price, support institutions)
- In the past we took a lot of this for granted
- Now the stability of all of them is questionable
- We have to deal with all of them
- They are interdependent
- They are hierarchical
The data problem

- I think part of the problem is a lack of understanding of the whole picture – which is admittedly very complex
- A farmer can be environmentally resilient (resistant vars., modest production, several seals) …
- … but s/he can still go bust because of the global situation
- David Griswold 31st Oct: “we have a broken industry”
- We lack the data and transparency to truly depict resilience levels and problems with it over the coffee world
- A primary necessity therefore is to collate a present data so that all stakeholders understand the situation
- The truth is that coffee industry data is very poor
This is wrong!

This is a $100 bn/year industry and we have no idea about true size of global coffee land stocks!

Neither total area nor land turn-over rate
Coffee boom countries

- Globally, coffee is less sustainable now than 20 years ago

Annual deforestation levels for new coffee – between 100 & 200,000 ha per year
We do know that major deforestation can alter local climates

- e.g. Loss of canopy-intercepted water linked to a 25% reduction in annual precipitation around Kilimanjaro

The forest pump theory:
- Air rises over areas with more intensive evaporation, such as forests.
- Resulting low pressure draws in additional moist air, that then falls as rain
- Tropical forests mitigate warming through evaporative cooling
- Climate model simulations show that tropical forests maintain high rates of evapotranspiration, decrease surface air temperature, and increase precipitation compared with pastureland
- Deforestation is still happening in Central America

<table>
<thead>
<tr>
<th>Country</th>
<th>Total deforestation 1990-2010</th>
<th>Annual loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guatemala</td>
<td>1,091,000 ha</td>
<td>54,550 ha</td>
</tr>
<tr>
<td>Honduras</td>
<td>2,944,000 ha</td>
<td>147,200 ha</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>1,400,000 ha</td>
<td>70,000 ha</td>
</tr>
</tbody>
</table>
Trying to piece together the weather story
Coffee & Climate project (www.coffeeandclimate.org)
e.g. El Salvador: Chalaltenango, Metapán example of comments

1960 famine – rainy season failed
2008 tornado
Since 1995 have noticed temperature increase

“20 years ago the river passed close to the community; now we have no water – this is part of the problem, the community has no water”

“In recent times the rainy season has not been consistent – it rains for a week, stops for a week, starts again for another week. That’s what happened to the rainy season of 2012.”

- Is this something that would favour Roya: intermittent rainfall?
- This is the sort of thing that happens with deforestation
What happened in Central America?
Our main hypotheses: Climate
(J Avelino, ICO meeting Sept 2013)

COSTA RICA, ICAFE

The rainy season, in the second half of the year, was interspersed with dry periods, with an increase of temperatures (especially minimum temperatures)
All these interactions may be happening in Centam

- But we don’t know the strength of their effect
- Nor do we know the implications
- A number of small changes could lead to a tipping point
- Could disease outbreak be one of them?
- It’s possible— it does happen
Looking at the context
CentAm coffee has been struggling for many years

- Example: amplitude of production in Nicaragua
- Main cause has been alternating wet and dry conditions linked to El Niño/La Niña type conditions
Coffee in long-term decline in several countries

- Costa Rica green coffee production [1000s tonnes; ICO data]
- El Salvador green coffee production [1000s tonnes; ICO data]
- Guatemala green coffee production [1000s tonnes; ICO data]
- Honduras green coffee production [1000s tonnes; ICO data]
Our dilemma

- A major challenge for us now is how to help Central American coffee farmers
- Should they be trained to apply chemicals properly?
- Or help to switch to catimors?
- Subsidize them to do so?
- Or helped to diversify out of coffee?
- Two main specific unknowns:
  - Return time for rust
  - Near-term price range for coffee
- Plus a lot of other ‘known unknowns’: other pests, diseases, long-term price range, cost escalation, etc.
- A major human weakness that we must acknowledge is that we often tend to want to return to a previous state
- Resilience thinking tells us to beware of this
Resilience

- Tackling rust – to get back to where we were before?
- Means we take on problems in a ‘one-off’ serially reactive fashion to get us back to the *status quo ante*?
- The simplistic view of resilience:

This is a wrong view of resilience

This too is a poor view of resilience

Engineering resilience concept

Ecological resilience concept
Stable equilibrium of a system 
e.g. coffee
Somewhere in Central America
Doesn’t have to be worse
What sort of resiliency do you have in mind?
It’s our choice

- Let the market decide?
- Lobby to re-introduce quota system?
- Global effort to mitigate?
- What should we do:
  - At the farm level
  - The community level
  - The local ecosystem/landscape level
  - Countrywide
  - Globally
True resilience means change

- “Resilience is the capacity of a system to absorb disturbance and reorganise while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks.” [Brian Walker, 2004]
- There is a continuum of approaches – from trying to rebalance an existing system to transformational change

![Diagram showing the intensity of change and resilience]

Source: Béné et al. 2012
Roya & climate change

- Yes there is a relationship: because the disease is affecting coffee at higher altitudes than before.
- But what caused the 2012-13 problem is not clear because it was not a particularly unusual year in terms of weather.
- If intermittent rain played a part – that is worrying because it might mean that there are local internal changes occurring.
- We are seeing very large temperature changes in Vietnam Central Highlands for instance.
- So it could be that not only is climate change affecting coffee, but also that coffee is affecting climate change.
Our dilemma – what to tell Centam farmers: What to do?

- First upgrade our own knowledge
  - What happened and why?
  - What is the full picture of Centam coffee (environment, social, economic, political)
  - How does this relate to what is happening globally to coffee?
- Develop plans for solutions and test them out first with farmers in scenario workshops
- Then various forms of implementation
- No single plan – we don’t know what the future holds
- So we need to be creative, think diversely
- And we need to think big – farm-by-farm certification won’t do the job
Need to evaluate the big picture major disparities in resilience

<table>
<thead>
<tr>
<th>Country</th>
<th>Climate</th>
<th>Technical support</th>
<th>Infrastructure</th>
<th>Financial support</th>
<th>Security</th>
<th>Cost regime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>Benign</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Expensive</td>
</tr>
<tr>
<td>Vietnam</td>
<td>Relatively benign</td>
<td>Poor</td>
<td>Moderate</td>
<td>?</td>
<td>Good</td>
<td>Becoming more expensive</td>
</tr>
<tr>
<td>CentAm</td>
<td>Difficult</td>
<td>Poor</td>
<td>Declining</td>
<td>Poor</td>
<td>Difficult</td>
<td>Expensive</td>
</tr>
<tr>
<td>Tanzania</td>
<td>Difficult</td>
<td>Poor</td>
<td>Poor</td>
<td>Poor</td>
<td>Fair</td>
<td>Less expensive</td>
</tr>
<tr>
<td>Colombia</td>
<td>Difficult</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Less difficult</td>
<td>Expensive</td>
</tr>
</tbody>
</table>
## Risk quantification

<table>
<thead>
<tr>
<th>Country</th>
<th>Climate</th>
<th>Technical support</th>
<th>Infrastructure</th>
<th>Financial support</th>
<th>Cost regime</th>
<th>Security</th>
<th>Overall Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Vietnam</td>
<td>2.5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>14.5</td>
</tr>
<tr>
<td>CentAm</td>
<td>5</td>
<td>4</td>
<td>3.5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>24.5</td>
</tr>
<tr>
<td>Tanzania</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>23</td>
</tr>
<tr>
<td>Colombia</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>3</td>
<td>17</td>
</tr>
</tbody>
</table>

**Notional figures only (discuss)**

1 = low risk factor; 5 = v high
We need much better data about costs

- Will the extra cost burdens of rust control, adaptation be worth it?
- In the first instance we need to know what full costs are
- It is very hard to find good estimates of full production costs

<table>
<thead>
<tr>
<th>A reasonable family income</th>
</tr>
</thead>
<tbody>
<tr>
<td>All other costs</td>
</tr>
<tr>
<td>Capital, investment, rent etc.</td>
</tr>
<tr>
<td>Production costs</td>
</tr>
</tbody>
</table>

- For each country what are the real figures?
We need much better data about costs

- It is very hard to find good estimates of full production costs

- Unreliable weather means farmers are taking on more risk

- Coffee is becoming a more risky business – increasing uncertainty

- In any business, when risk and uncertainty increase, prices should rise to compensate

- This is not happening

<table>
<thead>
<tr>
<th>A risk premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>A reasonable family income</td>
</tr>
<tr>
<td>All other costs</td>
</tr>
<tr>
<td>Capital, investment, rent etc.</td>
</tr>
<tr>
<td>Production costs</td>
</tr>
</tbody>
</table>
Based on improved knowledge
Start strategizing

<table>
<thead>
<tr>
<th>Countries</th>
<th>Intensify</th>
<th>Partial diversification</th>
<th>Abandon coffee completely</th>
<th>Move/exploit</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Brazil</td>
<td>Yes</td>
<td>No</td>
<td>NE &amp; NW MG?</td>
<td>Little</td>
</tr>
<tr>
<td>Vietnam</td>
<td>Some</td>
<td>?</td>
<td>Lowest soon?</td>
<td>Yes</td>
</tr>
<tr>
<td>Tanzania</td>
<td>Yes</td>
<td>Already diversified</td>
<td>Lowest &amp; middle altitude</td>
<td>Little</td>
</tr>
<tr>
<td>Colombia</td>
<td>?</td>
<td>?</td>
<td>Lowest altitude</td>
<td>Some?</td>
</tr>
</tbody>
</table>
Indicators for Centam resilience

- One suggestion: level of deforestation
- Hypothesis: as the region continues to deforest, it will become less resilient to climate change
- Global CC + local induced CC = potential disaster
- A test of the seriousness of the region in becoming generally more resilient?
- If governments are not willing to stop deforestation, how can we really talk about extreme resilience
Final thoughts
Coffee is a complex system

- Coffee is part of a very complex socio-environmental system
- Which is impossible to fully understand
- Has many non-linear features
- Linked to many non-coffee issues
- What will be the next problem: roya again, or something else – we don’t know
- We can’t solve all these problems
- But, coffee is an iconic product – attracts huge interest
- We can act as catalysts
- But needs a coherent response from the broader industry
- Not just ourselves (i.e. a concerned and informed minority)
Which is more resilient? This:

Certified farms

Landscape
Which is more resilient?
Or this:

- Seeing the wood for the trees?
- It’s no good having a sustainable farm in an unsustainable landscape
What do you do when faced with risk and uncertainty

- No doubt that farmers’ risks have increased
- Classically, if you are facing risk, you hedge your bets
- It’s what all smart companies do
  - Example: Bill Gates launching Windows for the first time
- Hedge your bets – diversify
- Plan A, Plan B, Plan C, etc.
- But what are we telling farmers?
- I think we are telling them:
  - Intensify - you will need to spend more to control roya (and broca etc.)
  - So you will need to intensify production
  - Borrow more and spend more to earn more
- But in a risky environment, this is a gambler’s strategy
- And resilience thinking tells us that this could be wrong
Resilience theory
The Haiti Syndrome

- All systems have their tipping points
- Hard to see them coming
- The idea is to retain diversity, feedbacks
- Don’t push things too far
- Retain slack in the system
- Have more than one plan
The Haiti syndrome
Resilience for Centam

- Alternatives:
  - Keep on with the existing paradigm – up the ante, intensify, keep betting on coffee
  - Look to the future – develop alternatives, diversify – almost certainly that means less coffee, not more
  - Or intensive coffee in some places and a pathway out of coffee in others
- What ever happens, we need to understand the Centam socio-environmental system a lot better
- Resilience is all about how we understand and deal with complex things
- The debate to date has been too simplistic
- Yes – metrics have to evolve, be diverse
- Sustainable schemes are going the other way - converging
We can’t come with a fixed set of rules

I don’t know about you, but I’ve only found a couple that work for me.

Thanks to Jesse Caldwell  (See Exodus 20:1-21)  02-07-2001
Take-home messages

2. Fixing rust won’t make coffee extremely resilient.
3. Centam is a climate change hotspot – increasing evidence of climate change.
5. Centam coffee farmers are in a very risky situation: CC problems, difficult terrain, high costs, poor government support, low world prices, strong (and sometimes unfair/unsustainable) competition from other coffee-producing countries.
6. Because of above, Centam coffee is in long-term secular decline – this despite 20 years of intensive activity on sustainable issues.
7. Implies we need a much more deeply thought out, diverse, ecologically sensitive response – we can’t keep on repeating the same old recipes.
Take-home messages

8. Need a full-scale diagnostic of Centam situation and relate to the world picture

9. Must inform farmers and other stakeholders of local and global realities

10. Think in systems terms: not just coffee but socio-environmental systems

11. Think in terms of the bigger picture: we need to protect the landscape

12. Decide what you mean by the word resiliency – it has many meanings

13. We need more than a Plan A: because we can’t tell what will happen, we need to hedge our bets

14. Entertain the possibility of ‘regime change’: the Haiti syndrome is not an unimaginable future for parts of Centam
Final thought from Demos
[a not particularly right-wing think-tank]

“Next generation resilience relies on citizens and communities, not the institutions of state...”

DEMOS