

# Some thoughts on Management of drought risk

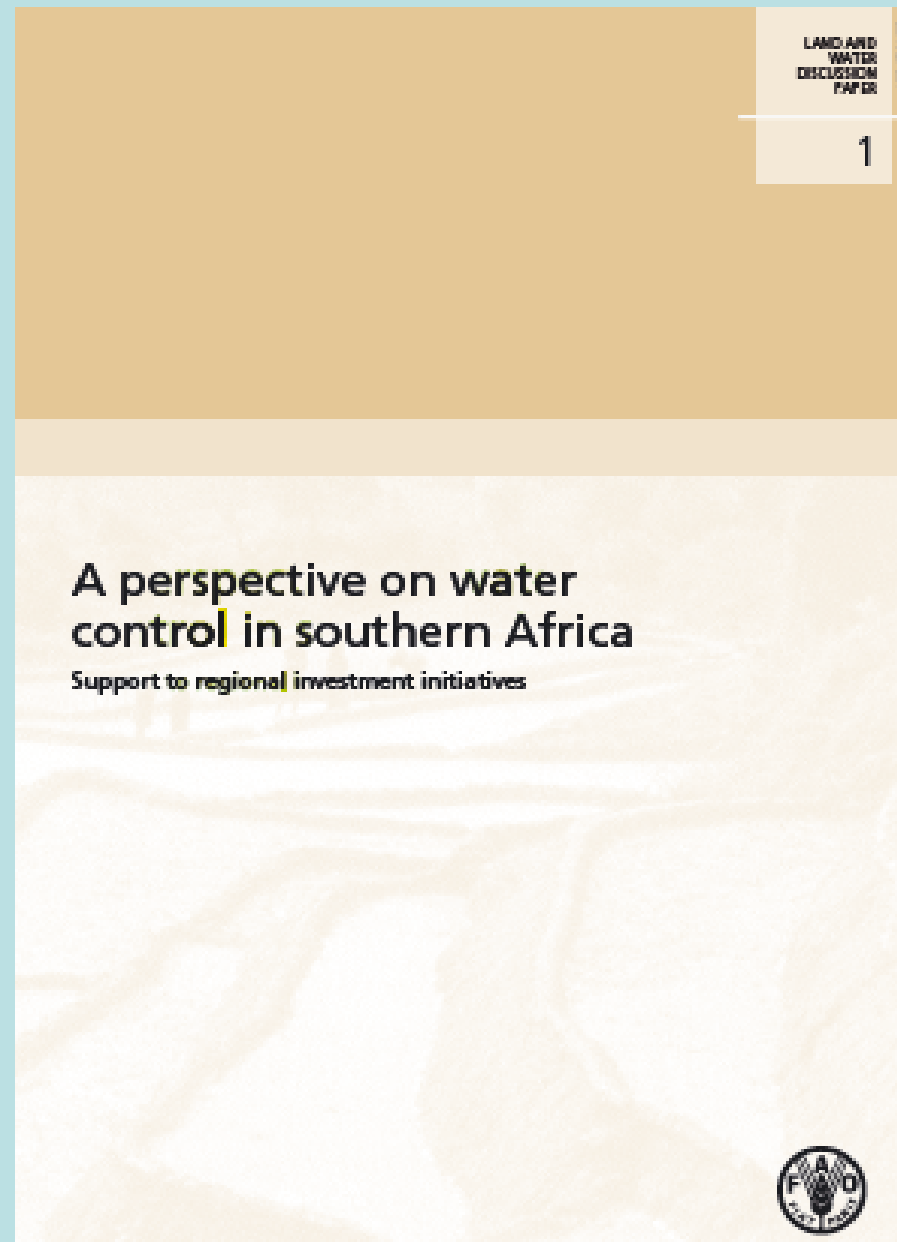
Michael Snell

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Presentation of a brief paper  
drawing on work done for FAO in Harare in 2003, relating to  
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(mainly in Annex 6 thereof) ...

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Many farming systems, rainfed or irrigated, are vulnerable to drought.

There is a wide probability spectrum, from mild droughts that can be expected to happen a few times each decade, to rare and very severe droughts that might occur only once in a century.

With climate change, probabilities are shifting, often for the worse.

There always was a need to manage drought risk, but now it's getting more urgent and more important.

Managing drought risk can reduce hunger and poverty, by cushioning the impact on livelihoods in drought years.

# Two main ways to manage drought risk:

- Technical ways (agricultural practices, soil and water management, forecasting),
- Institutional ways (risk sharing, drought relief arrangements).

# Technical ways to manage drought risk:

- In drought-prone farming, farmers can manage the risk
- ... by **choosing less drought-resistant crops**,
- ... or by **improving storage of water**, either in surface reservoirs, or in aquifers, or in the crop root zone

[**Water storage** is the key, whether for a few weeks (root zone, small dams) or between seasons (bigger dams) or between years (very big dams).]

But this paper is about the  
institutional ways to manage drought risk:

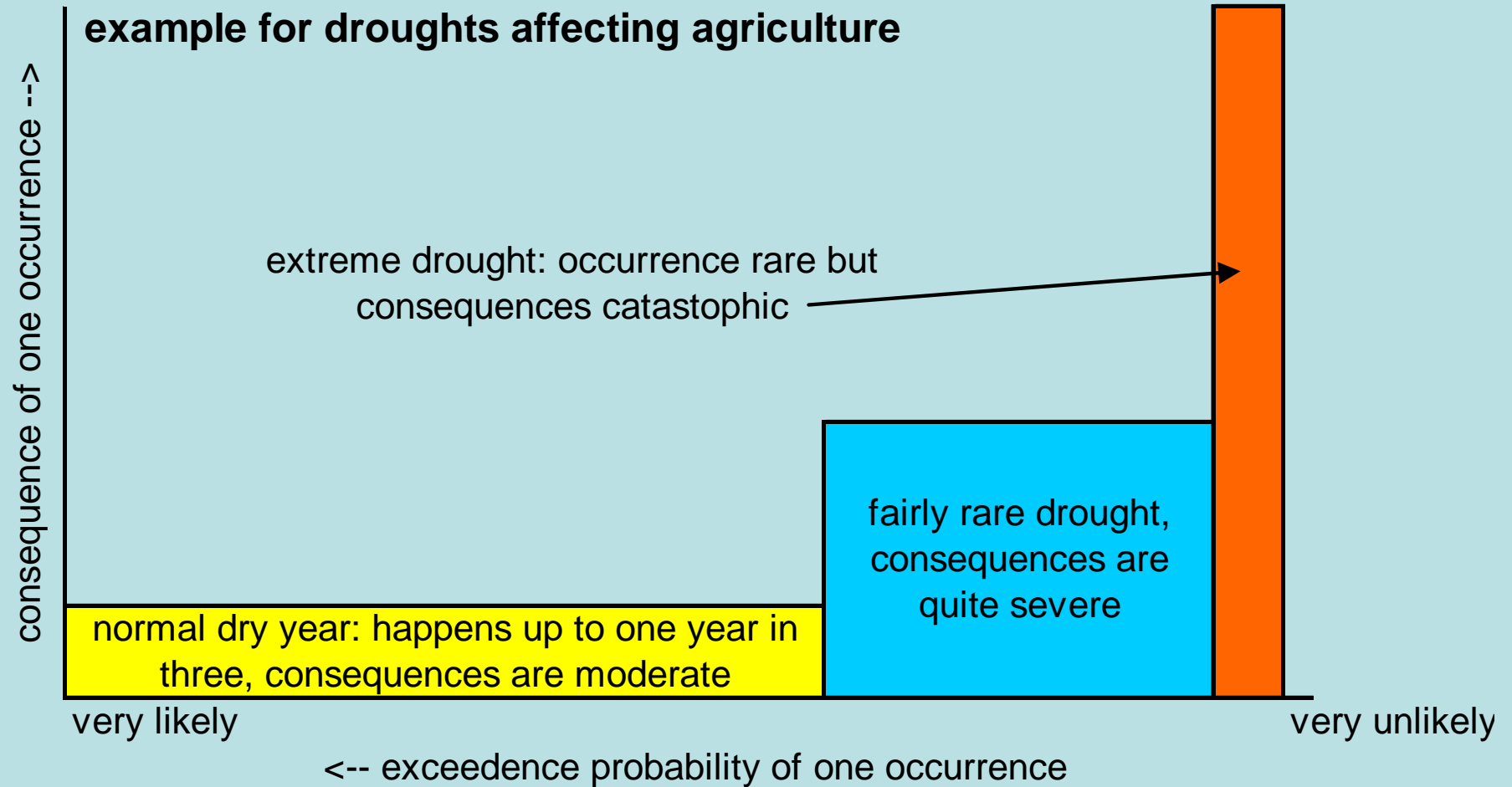
- Share the risk between different people,
- Spread the risk over different years,
- Prepare rapid responses to drought situations.

We need to be clear about the

## Spectrum of probabilities

... from mild but fairly frequent sorts of drought, to rare and very severe ones.

## example for droughts affecting agriculture



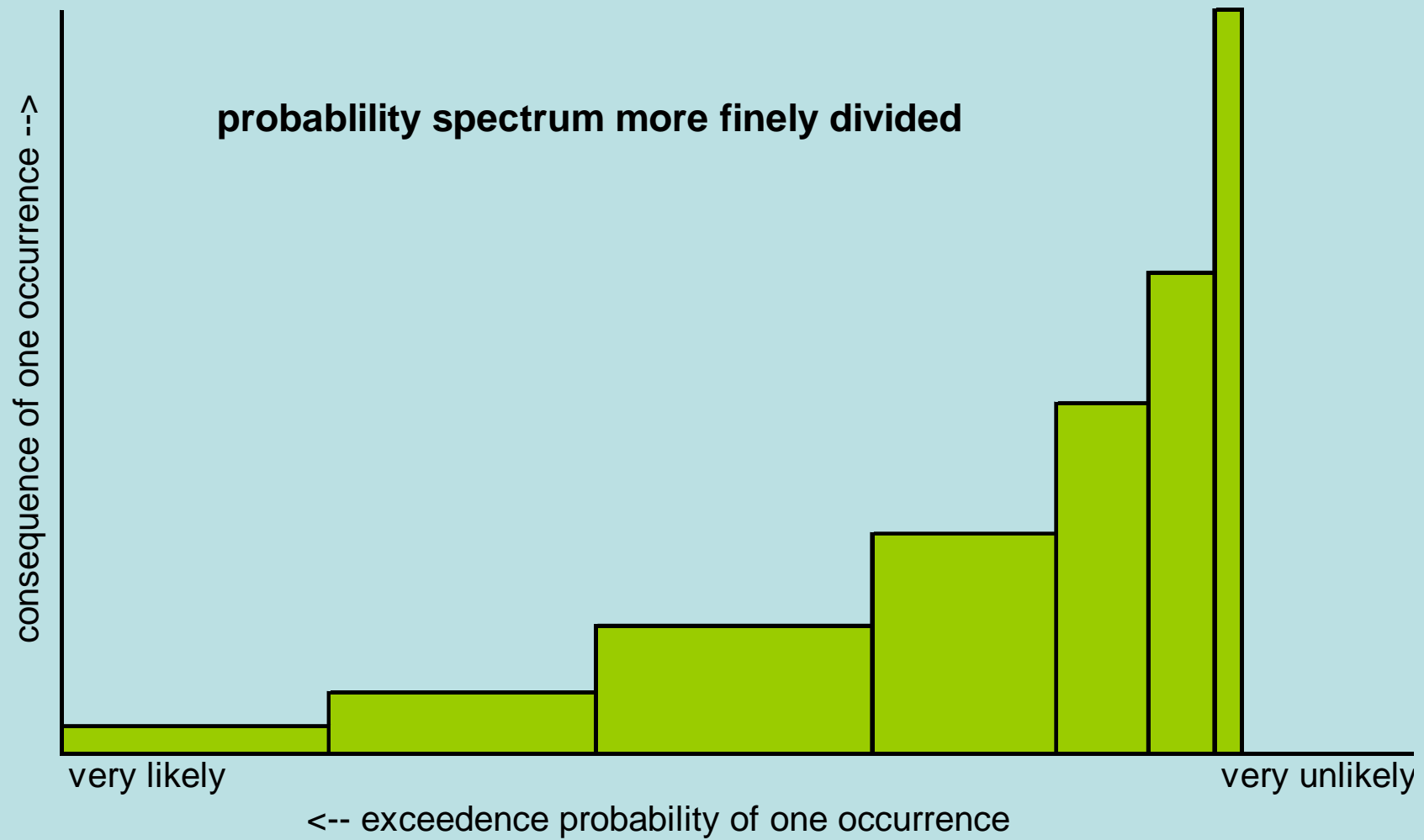
# Defining the terminology ...

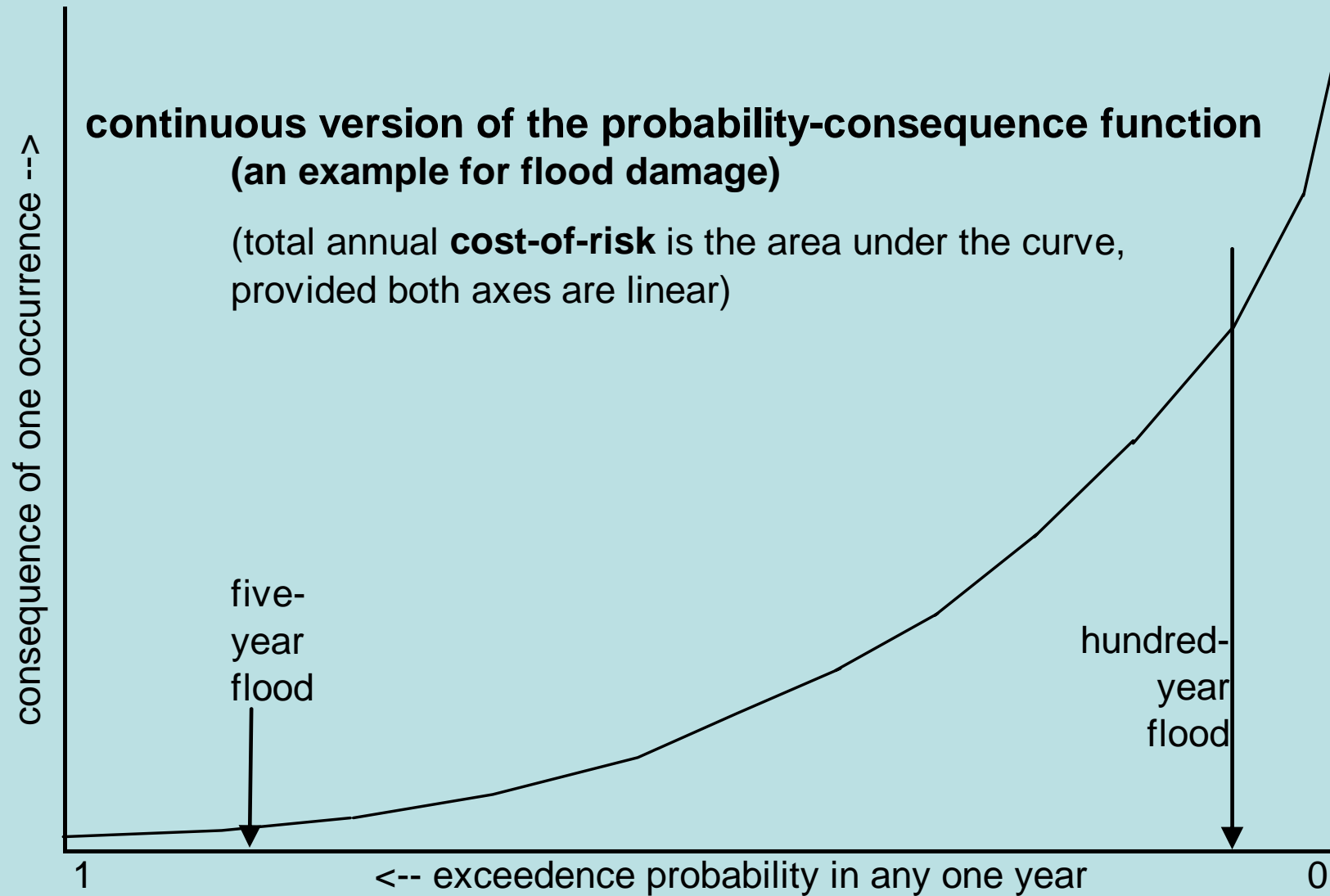
- **Cost-of-risk** for a single undesirable event (flood, drought, hailstorm, earthquake ... ) is:

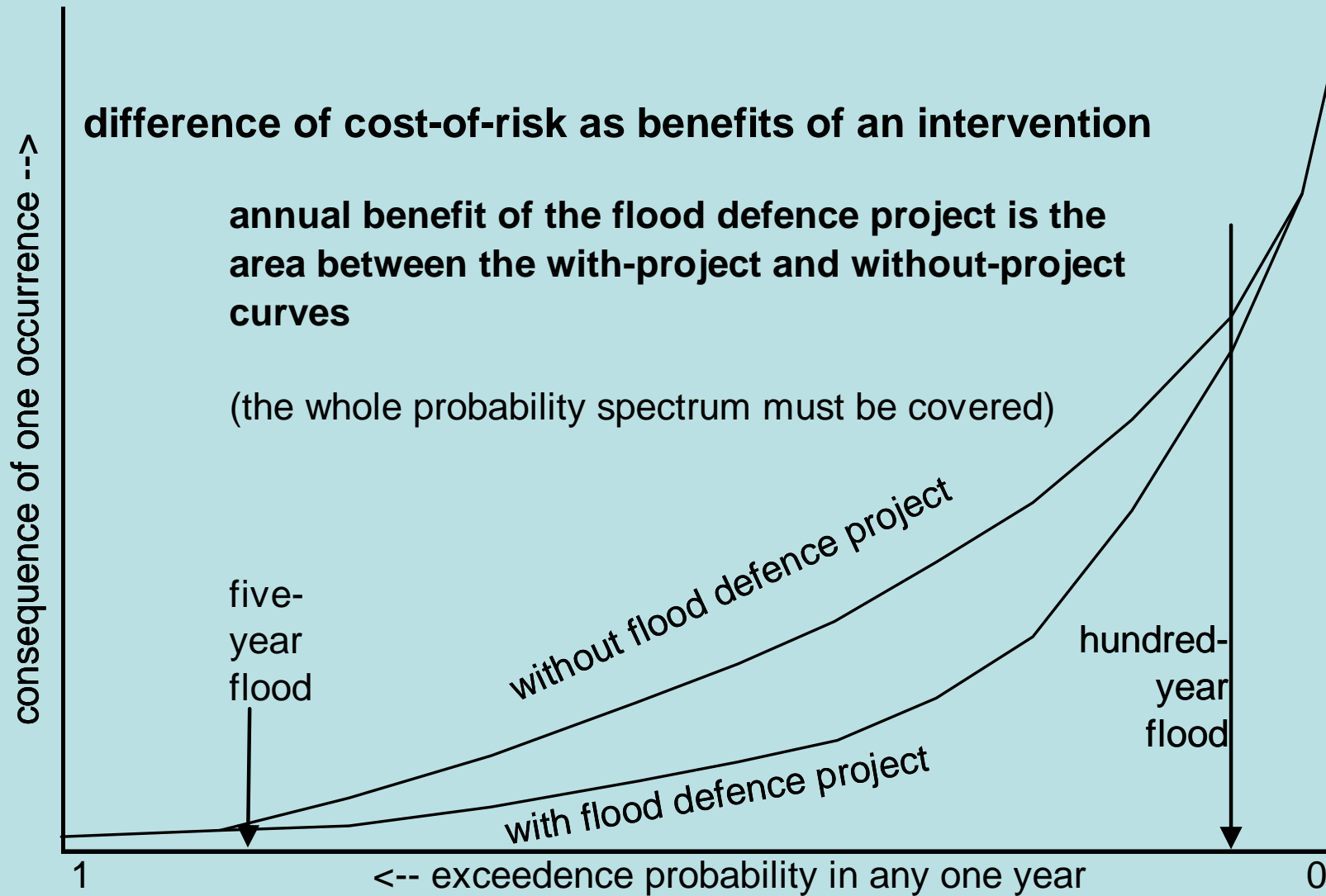
Damage due to the event

multiplied by

Probability of its occurrence







How to use these concepts to design institutional ways of managing drought risk?

- Sharing and spreading the risk ...
- ... but sharing between whom?
- ... between the farmers directly affected?
- ... between the citizens of a whole nation?
- ... over the whole international community?

Wide risk sharing, over most of the probability spectrum:

- If even the minor, frequent droughts are shared over a wide community, **incentives** are distorted.
- This may happen when local markets are distorted by the arrival of large quantities of donated food.

- Or incentives may be distorted when a farmer thinks:

“If I farm prudently, so as to cover the risk of moderate droughts myself, I will have my own food security but my average production and income will be lower than they might be.

If on the other hand I go for high-income but drought-vulnerable crops and methods, my average income will be higher, and when my system fails in a moderately dry year **someone else will rescue me from the consequences**”.

If people expect that wider society (government, aid agencies, NGOs) will step in, **even in moderate droughts**, that expectation will encourage irresponsible 'gambling' tactics on the part of individual farmers, which

- will be risky for farm families
- will be sub-optimal, for a whole nation, in an economic sense.

## Narrow or no risk sharing:

- Farmers will be risk-averse and plant only the most drought-resistant crops,
- ... which will reduce their overall production, and their families' nutrition, below what it could be with better management.

# So what we need is appropriate risk sharing for different bits of the probability spectrum.

The rarer the event, the wider is the appropriate risk sharing.

- A mild drought should be covered by a farmer's own coping methods.
- A slightly more severe one requires shared management over a considerable number of farmers.
- A more severe drought would need the declaration of a 'state of emergency' over part of a country, and the mobilisation of that country's reserves.
- A very rare and severe event would require and justify risk sharing over the whole human race, implemented through international relief operations.

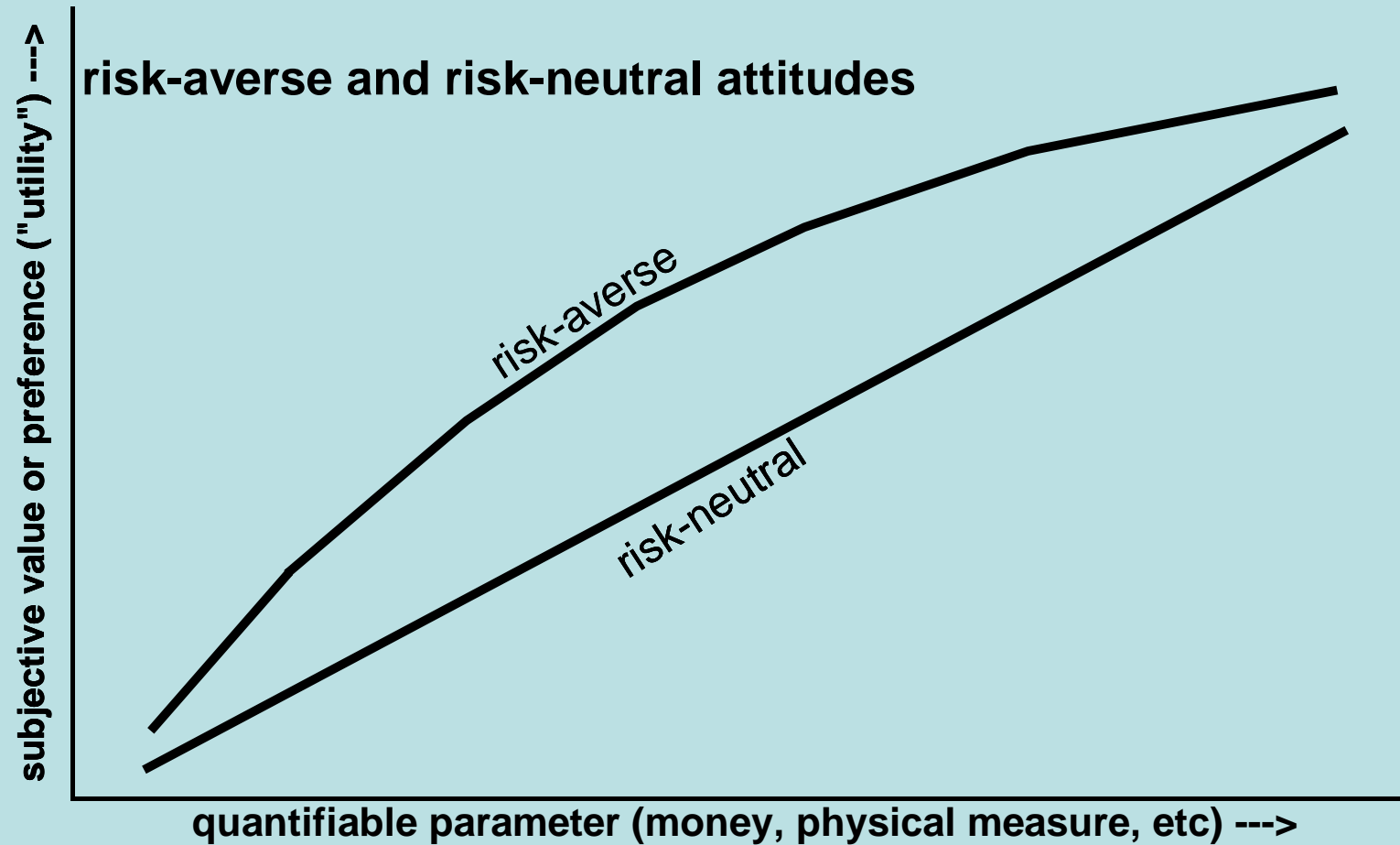
One way of managing risk is **insurance**

Risk is pooled over many farmers and spread over many years.

The benefit to each farmer is that he can go for more risky crops or farming practices that give high average income, while being protected from the consequences of occasional bad seasons.

The benefit for the insurer is that, if the premiums are set right, the premium income will be higher than the aggregate cost of risk, and the difference is the insurer's reward.

This works because individuals are rightly **risk-averse**



A second way of managing risk is

## **national risk-sharing:**

A government can arrange the sharing of many people's risks, and the spreading of risk over many years, in effect taking on the role of insurer.

It can do this with an explicit “national insurance” scheme, related to specified risks and to which citizens have to pay contributions ...

or it can do it out of general tax revenue which spreads the risk wider, and perhaps unequally if richer people pay more tax.

A third way of managing risk is

## **Global or international risk-sharing:**

This is similar to national risk-sharing except that the community over which the risk is pooled and spread is larger;

again the cost may be unequally borne, for instance rich nations effectively bearing much of the drought risk of poorer nations.

This can be arranged by international public bodies (bilateral or multilateral, UN, etc) or by international NGOs.

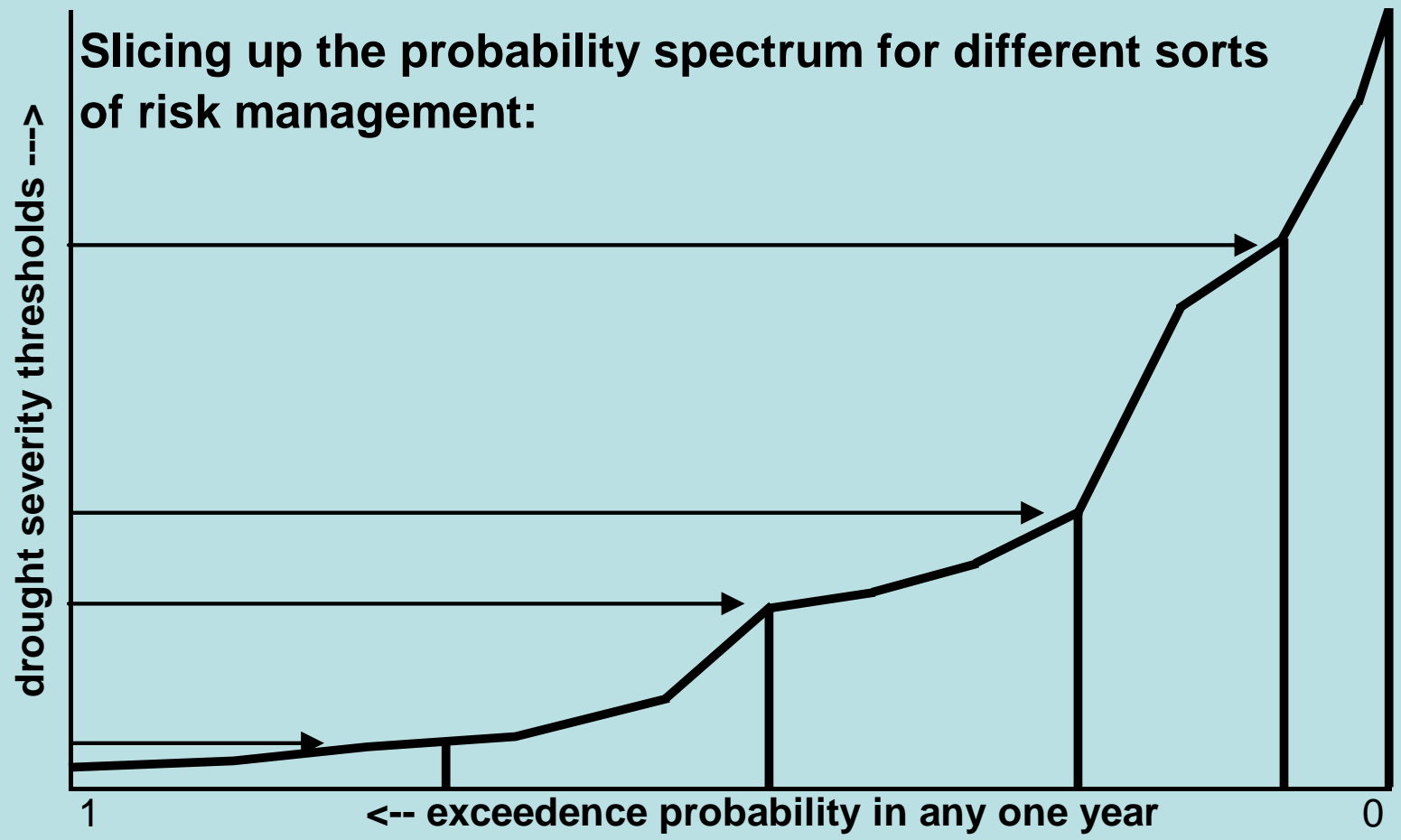
The economic principles underlying the design of a risk management set-up include:

- the aggregate of cost-of-risk should be balanced against aggregate long-term-average production and welfare, for a whole nation or other large social group;
- the various actors must face **incentives** that lead them to act in a way that maximises overall welfare.

## Steps needed towards a risk-sharing set-up:

Whatever the group of people within which risk is to be shared, the design of any risk-sharing system or process requires:

- a way of **classifying droughts** for a particular purpose, such as a particular farming system;
- a way of **fixing the probability thresholds** which will trigger the automatic consequences.



Drought insurance schemes, and those dealing with hail or storm damage to crops, work like this.

# Classifying drought severity:

The severity of a particular drought depends on many things.

Partly it depends on 'antecedent conditions', like prior rainfall.

It also depends on what impact is involved, which among other things will determine what period's rainfall matters ... for example:

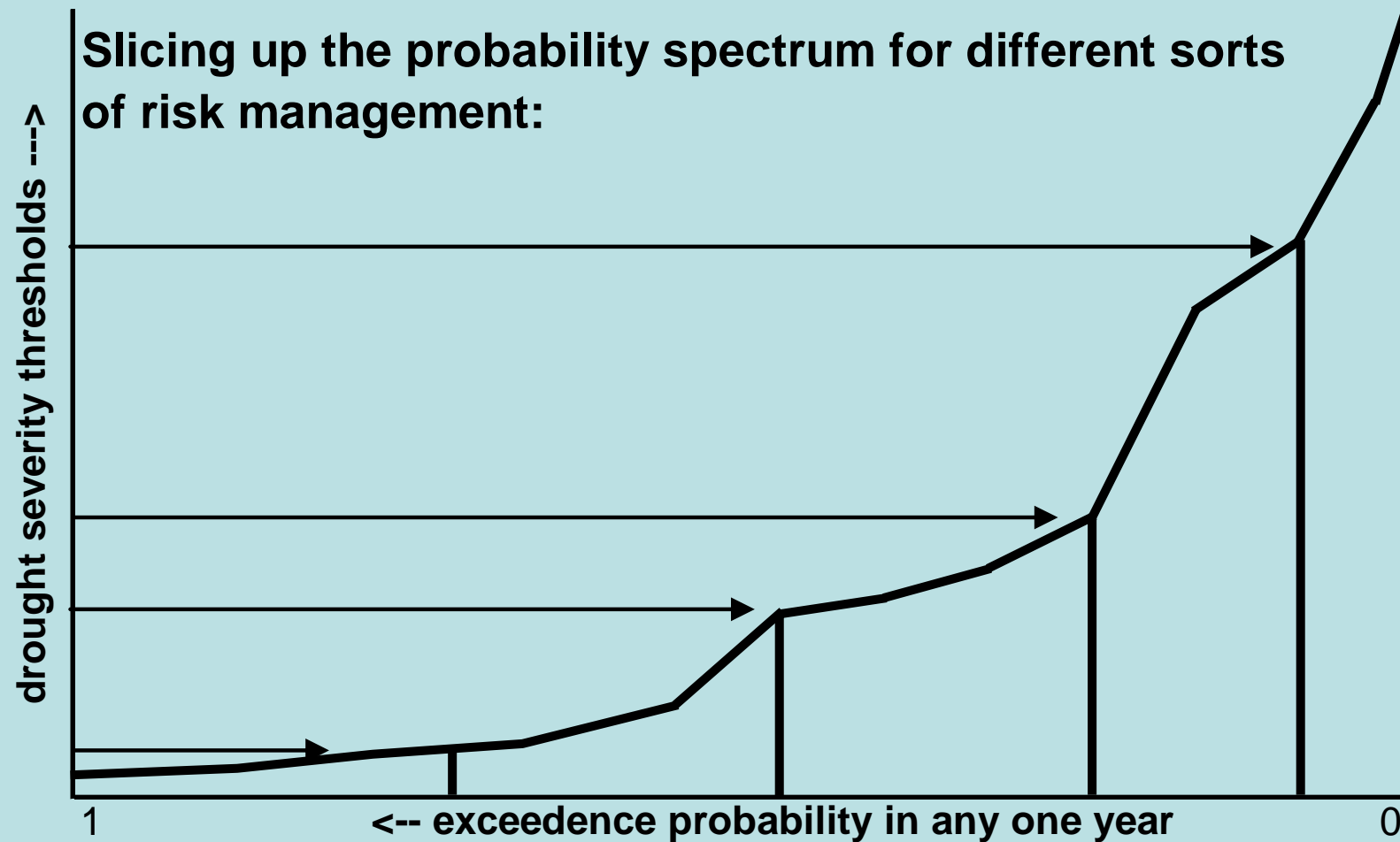
- One cropping season might be critical for some farmers because of a seven-week dry period in December-January, but be no trouble at all for other farmers because they have seasonal water storage.
- Another year, with moderately dry conditions from October to April, might be the critical one for people with limited seasonal storage.
- For farms irrigated by a very big dam with over-year storage, neither of those events might be as bad as a sequence of five below-average-rainfall years.

So we need a **drought severity index** which relates to a particular farming system in a particular place.

- Then we can draw up a severity frequency function of past droughts, and use it as a guess at the probability function of future droughts.

[This is like flood frequency analysis for designing a dam and its spillway.]

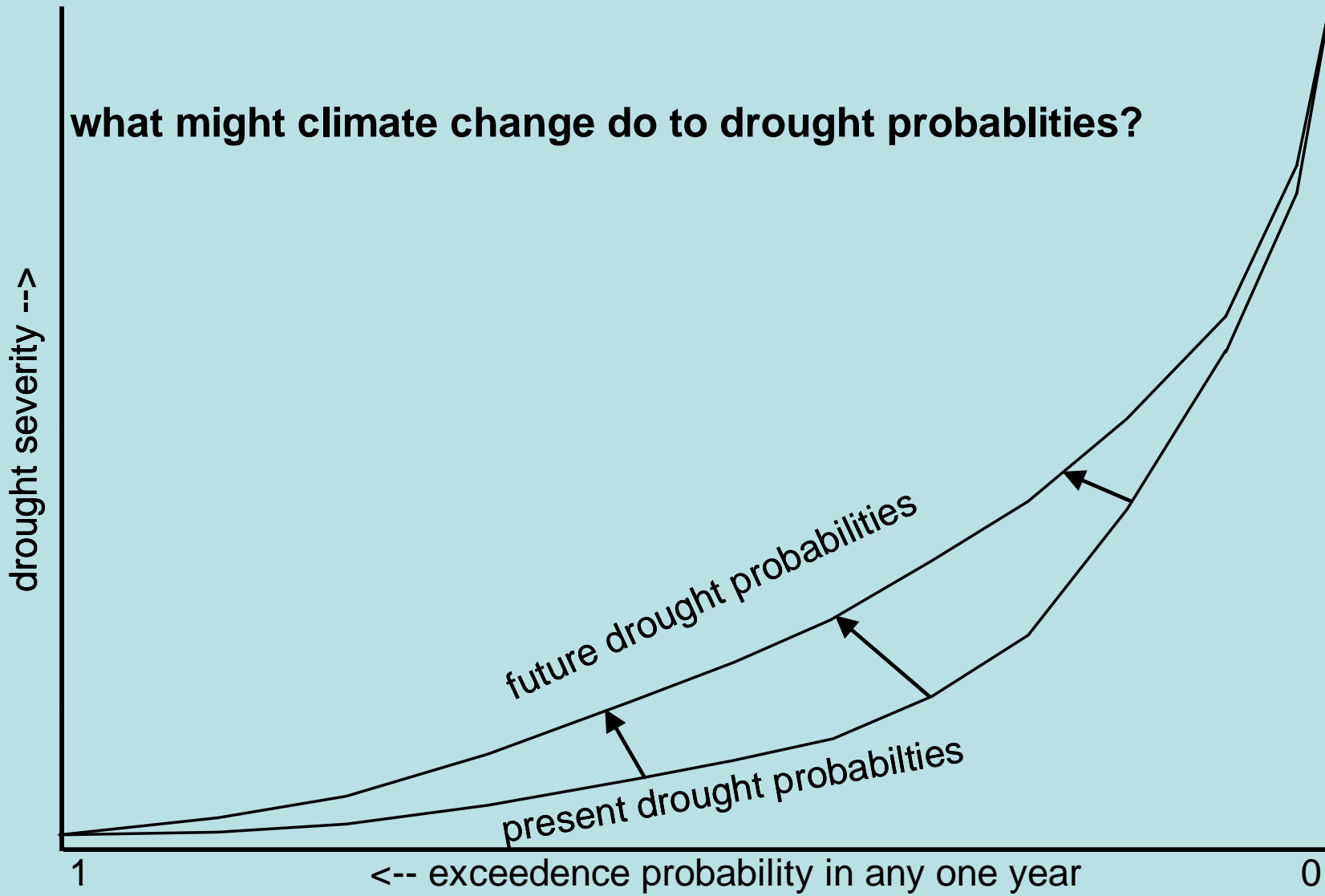
The spectrum is not usually a smooth curve, there are kinks related to physical thresholds.



Whatever the risk sharing arrangement, a risk management system can also benefit from **drought forecasting**  
(a technical procedure supporting an institutional measure).

- If a probabilistic drought forecast is issued before planting begins, some farmers may be able to modify their choice of crop or planting date to reduce their vulnerability.
- Tracking the El Niño Effect may give such a forecast for southern Africa, but experience so far is mixed (hence a ‘wolf! wolf!’ effect).

what might climate change do to drought probabilities?



So climate change will increase the need for drought risk management (both technical and institutional ways)...

... and increase the benefits from it.

The paper and this presentation present some preliminary thoughts about institutional risk management ... Is there more to be done?

# Questions to the learned colleagues:

- Is this all rubbish?
- Is it all standard textbook stuff?
- Is it mildly interesting but not much practical use?
- Is it worth pursuing further?
- Or what? ...

Copies of the 8-page paper are available  
on request

from

[msnell1999@aol.com](mailto:msnell1999@aol.com)