

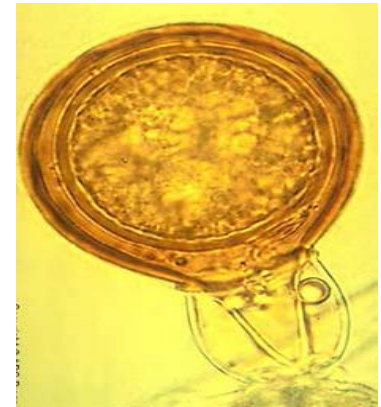
Emerging plant pathogens

Changes in geographical distribution

- The increased mean winter temperatures, shift in precipitation from summer to winter, and tendency toward heavier rain, which have been noted in central Europe, favor infection by several *Phytophthora* spp., and these species are responsible for increasing amounts of root rot in forest trees in this region



- Warming is causing a pole-ward shift of the agroclimatic zones and crops that grow in these zones.
- Example, predictions are made for northward migration and increased severity of Oak decline due to *Phytophthora cinnamomi* from the areas of current distribution
- Pathogens will follow migrating host plants that will lead to their dispersal and survival between seasons in new areas





- Increase in wet periods with soil temperatures of $12\pm 30^{\circ}\text{C}$ would favor *Phytophthora* disease in southeast Australia.
- Fast growing poplar clones grown in much of northern Europe are generally susceptible to thermophillic *Melampsora allipopulina*, but currently this pathogen does not constitute a major threat to poplar production.
- A change to warmer climate may have serious implications for large areas where poplar is being grown as an alternative to producing agricultural surpluses

Migration of pathogens to other hosts

- More aggressive strains of pathogens with broad host range, such as *Rhizoctonia*, *Sclerotinia*, *Sclerotium*, and other necrotrophic pathogens may migrate from agricultural crops to natural plant communities.

- In its native habitat in the USA, the fire blight bacterium, *Erwinia amylovora*, attacks indigenous plants of the family Rosaceae without causing significant damage.
- When European settlers grew apple and pear in some regions, the bacterium caused serious losses.



- Similarly, pathogens which are normally less aggressive in natural plant communities could devastate crop monocultures growing in close proximity.

- The coffee rust epidemic in Asia during the late 1800s was facilitated by growing an introduced susceptible host, *Coffea arabica*, in a region where the native pathogen, *Hemileia vastatrix*, was already present on alternative hosts in the forests outlining the coffee plantations

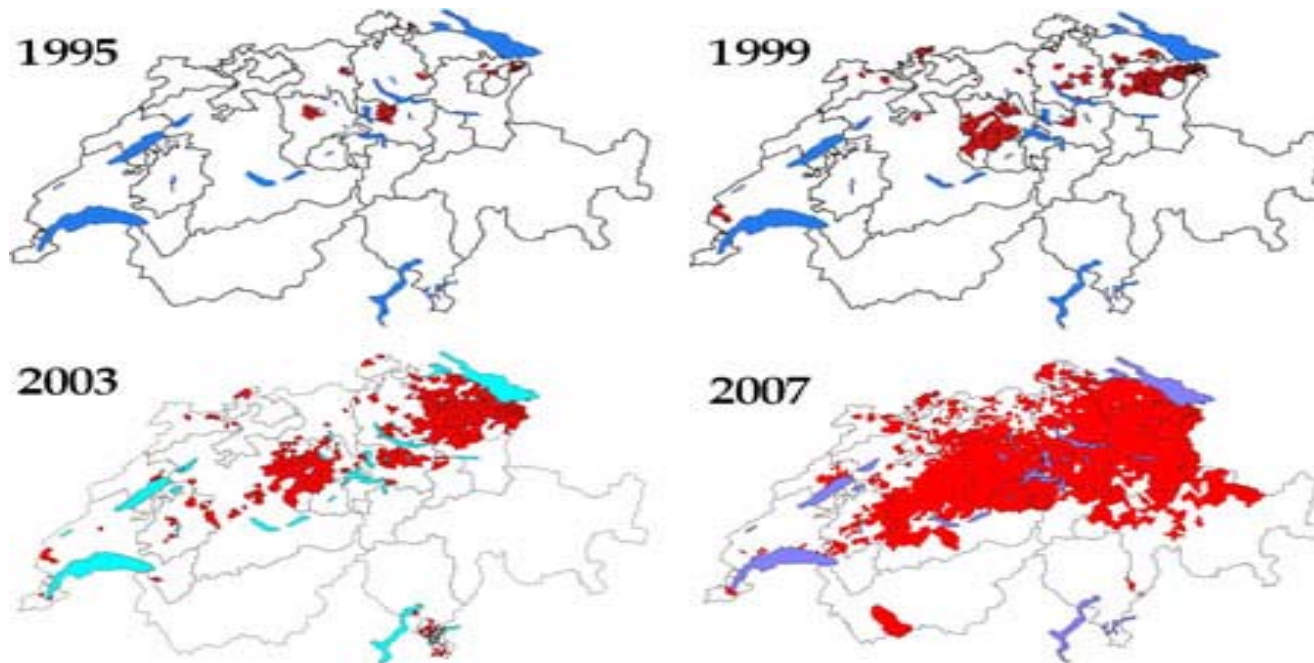


- Coast of Oregon, USA: winter temperatures and spring precipitation increased by 0.2⁰C–0.4⁰C and 0.7–1.5 cm, respectively, per decade since 1970.
- Swiss needle cast (*Phaeocryptopus gaeumannii*) causes chlorosis, reduced needle retention, and reduced growth in Douglas fir.
- A severe epidemic of this disease began on the Oregon coast in the early 1990s. It was positively correlated with warmer-day accumulation during winter and duration of leaf wetness during spring and autumn.

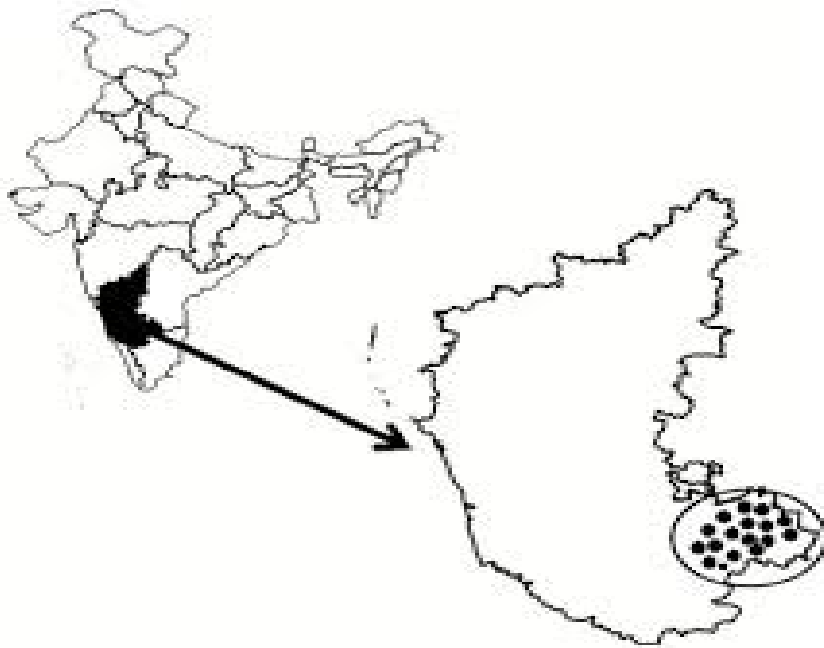


- Introductions of novel plant pathogens have already occurred in many regions, but climate changes are likely to often facilitate their further establishment and spread
- The Fire blight pathogen was introduced into Switzerland from South-West Germany in the 1980s.
- It affects tree and shrub species of the family Rosaceae (e.g. *Malus*, *Pyrus*, *Crataegus*) and is favoured by humid and mild springs, as was the case in 2007, when the epidemic reached unprecedented levels

Fire blight epidemic (*Erwinia amylovora*) in Switzerland



Phytophthora occurrence in tomato in South India since 2008



- The 13_A2 lineage of *Phytophthora infestans* was responsible for severe late blight outbreaks on potato and tomato in South India and has replaced the prior population represented by the US-1 and other genotypes.
- A severe outbreak of tomato late blight was also observed in 2016 in Uttar Pradesh

Dry root rot in chickpea (*Rhizoctonia bataticola*) since 2010



- Recent surveys conducted during 2010–2013 indicated widespread and increased incidence of DRR in the central and southern states of India. Disease was found irrespective of soil types, cropping system and cultivars used and incidence ranged from 5 to 50% or more in badly infected soils.
- It has become a major threat to chickpea production in recent years due to altered weather conditions, particularly on the account of longer drought spells.
- Higher temperature and soil moisture depletion during crop growth period particularly at post-harvesting stage are predisposing chickpea to DRR