

# Forest dynamics through the lens of volcanic disturbance: impacts of the 2008-2009 eruption of Chaitén (Chile) on peripheral Valdivian temperate rain forest.

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## AIMS & OBJECTIVES

### BACKGROUND

Chaitén in Southern Chile erupted in 2008-2009, destroying 4km<sup>2</sup> of Valdivian temperate rainforest with pyroclastic density currents (PDCs), lahars and tephra fallout. 13 years on, the forest is regrowing heterogeneously depending on the intensity, agent and timing of disturbance. This project hopes to attain successional timescales, account for differences in trajectories and find affinities to other eruptive events in volcanically disturbed forests, through a meta-community perspective.

### RESEARCH QUESTIONS

- To what extent do density-dependent biotic interactions affect primary successional trajectory?
- How do density-independent abiotic conditions (tephra thickness, aspect, disturbance patch extent) have an effect on recovery?
- What role do stochastic dispersal processes (immigration and emigration) in adjudication of community composition?

## CONCEPTUAL METACOMMUNITY MODEL

A metacommunity is defined as a “sets of local habitats that are connected by dispersal, and that species within each local habitat interact with each other and respond to local environmental conditions...” (Leibold and Chase, 2003). In the present study, a continuous region with discrete disturbed patches, an interstitial undisturbed matrix of primary forest, with disturbed patches interconnected via dispersal.

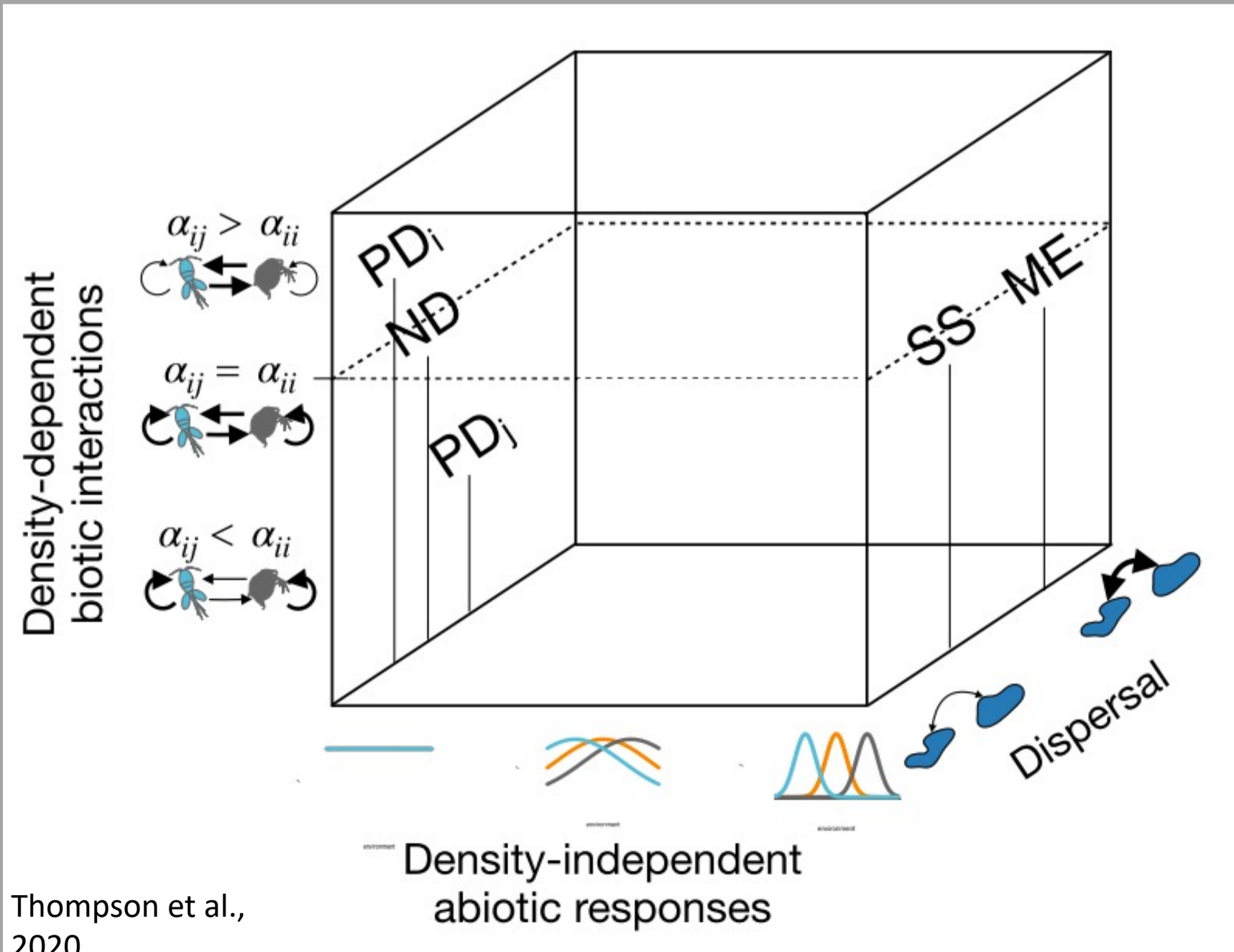
### AXIS 1: Density-dependent biotic interactions

Competitive and symbiotic relationships (facilitation/inhibition/mutualisms etc.). Endmembers of this theoretical axis have inversely dominant inter- and intra-specific competition among species, with a theoretically even balance between inter- and intraspecific interactions in the intermediate.

### AXIS 2: Density-independent abiotic responses

Environmental characteristics of disturbed patches which serve as niches for colonizing plant species to occupy.

- These include:
- Altitude
  - Tephra deposit depth
  - Aspect (insolation capacity)
  - Substrate characteristics
- Endmembers constitute highs and lows of niche differentiation.

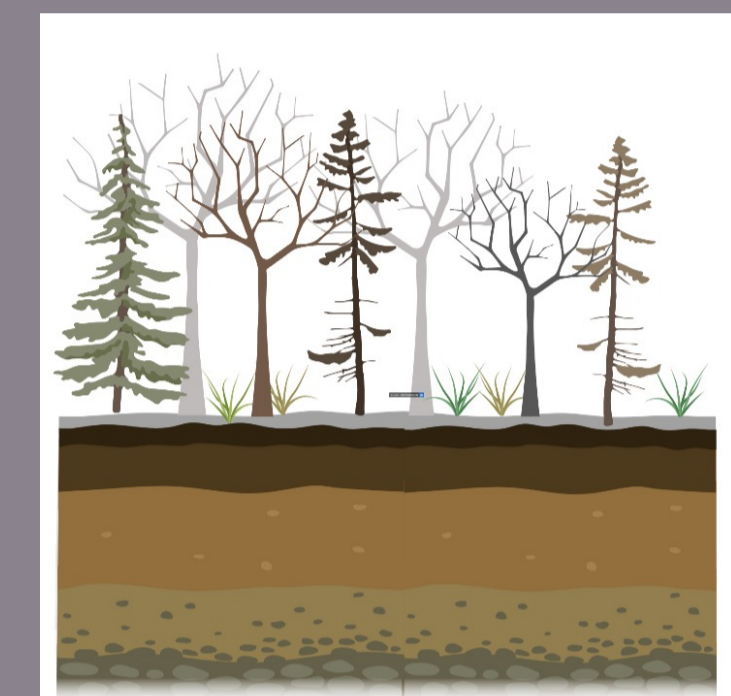


### AXIS 3: Dispersal

Stochastic processes of immigration and emigration into and out of disturbed patches. Endmembers are characterized by high and low rates of inter-patch dispersal.

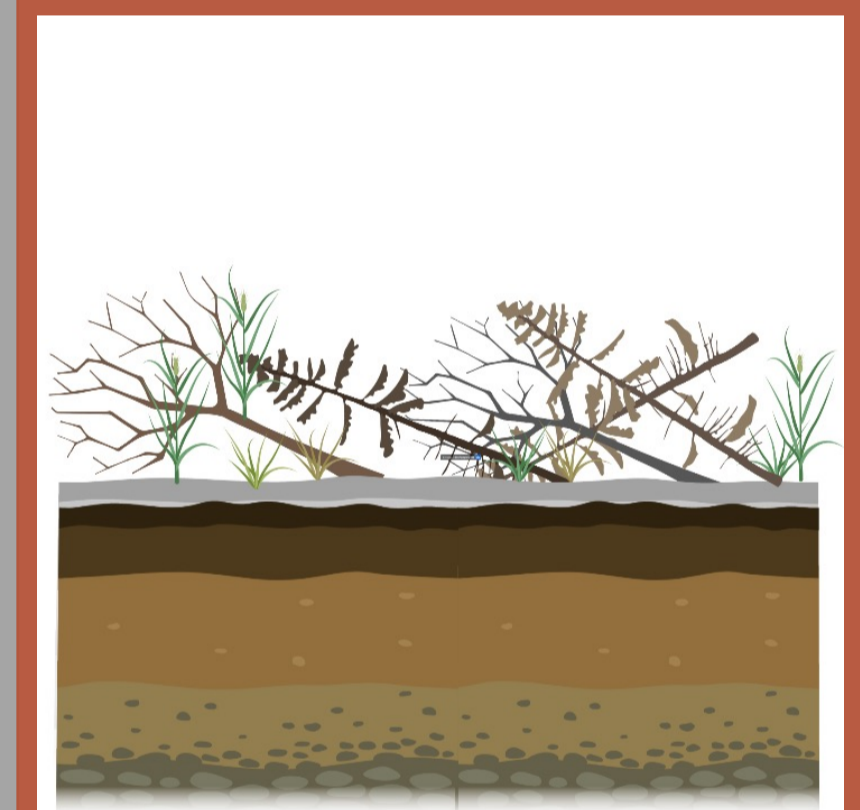
## DESTRUCTION ZONES

**MINOR**  
 Major canopy damage, removal in most places  
 Thin tephra deposits  
 Grasses, ferns and bamboos recolonizing forest floor  
 Snags resprouting



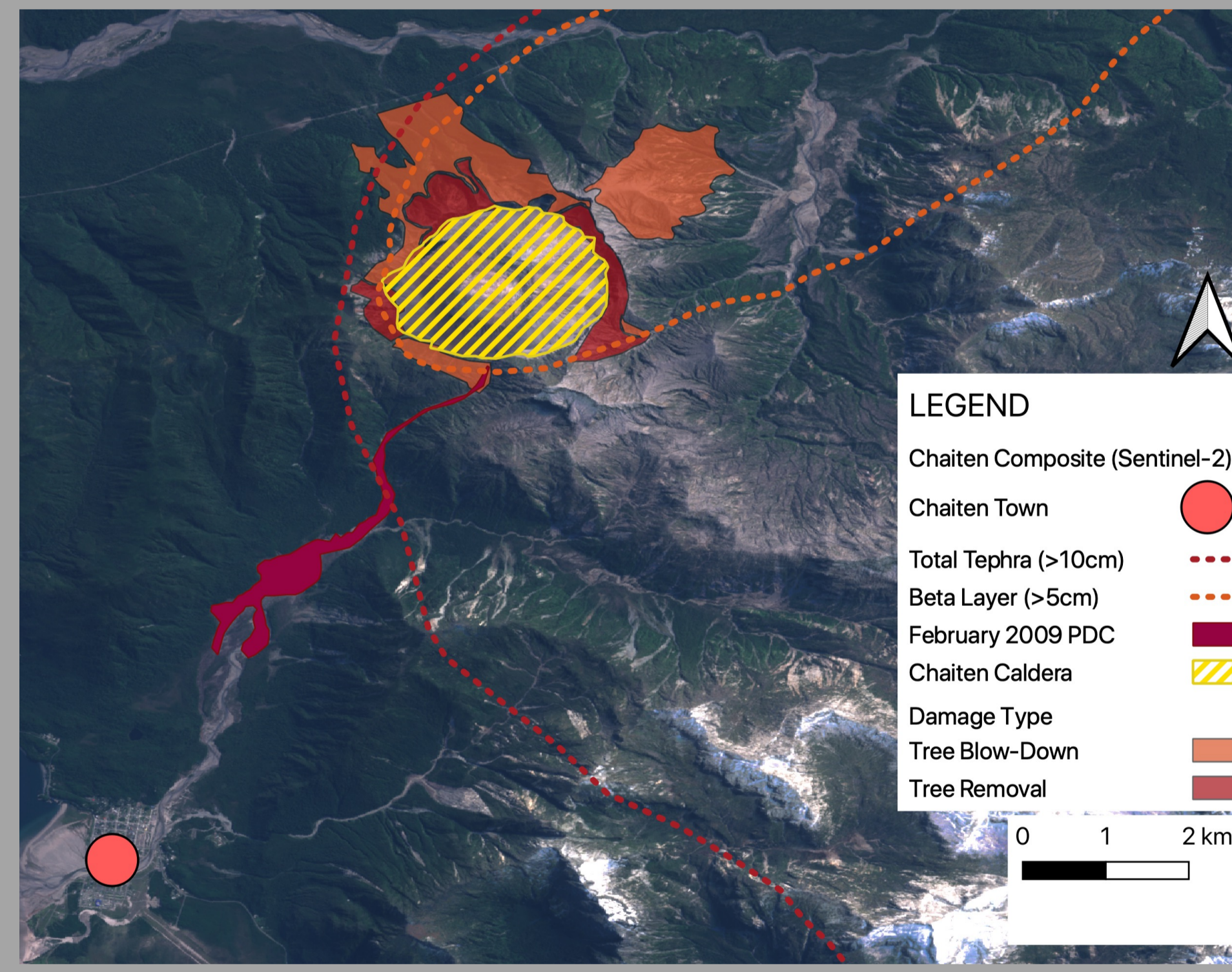
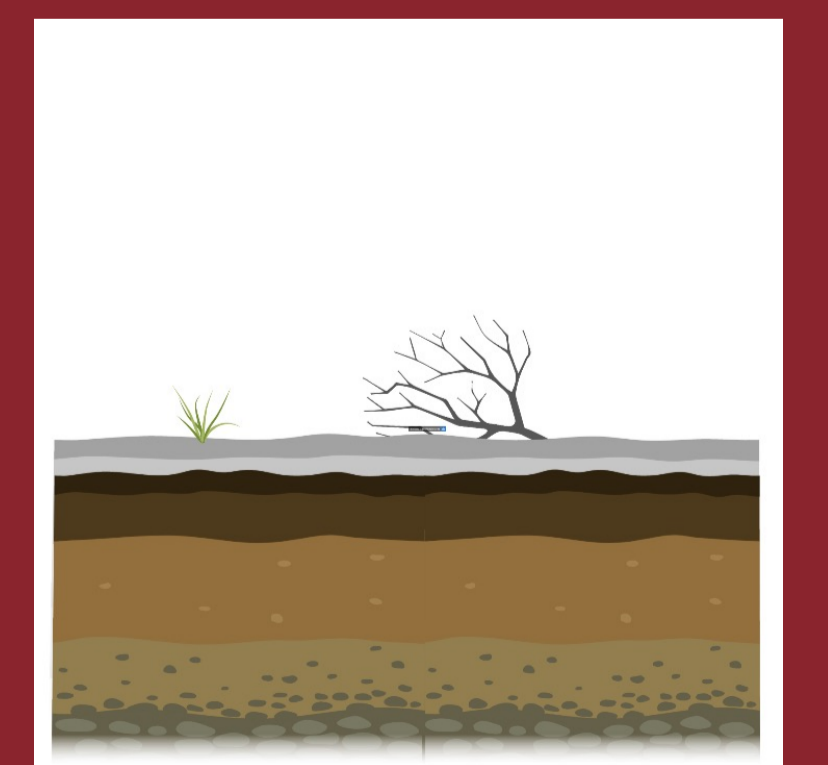
### TREE BLOWDOWN

Most trees felled in direction of lateral blast (away from vent)  
 Dead felled trees acting as organic nurse substrate  
 Medium tephra deposits inhibiting recolonisation



### TREE REMOVAL

Total destruction  
 Trees mostly removed  
 Minor recolonization from sparse organic soil and downed boles  
 Thick tephra deposits



**PDC ZONE**  
 “Block and ash” pyroclastic deposits from Feb-2009 dome collapse event  
 Inundated “Caldera Creek” river valley  
 Riparian forest intact in distal zones, damaged closer to topographic lows (path of the PDC)

