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Natural Hazards and Colorado Geology

Topic Summary

**Vegetation of Basaltic Flows**

Often, the first image that comes to mind when the word ‘volcano’ is mentioned is the typical explosive, pyroclastic eruption that destroys massive expanses of landscape, infrastructure, property, and occasionally, in the worst situations, life. Billowing concoctions of chemicals, gas, debris, and otherwise materials tens of miles into the air.11 However, these disastrous explosions are not the only instances where magma is produced from the earth. There are also non-explosive flows that can move slowly -or sometimes quickly- for miles around, melting away vast landscapes for years.11 It is upon these vast landscapes of destruction that only few lifeforms risk staking their home, and existence. Only vegetation with the evolutionary advancements and unique prowess can thrive in the harsh environments of basaltic flows. The first step in understanding the vegetation and revegetation of basaltic flow regions is understanding the flow-types.

There are two major types of basaltic, non-explosive flows; pahoehoe and a’a flows.1 The main distinction between these two types of flows are the recognizable physical features generated due to their contrasting flow rate. A’a flows are distinguishable by their rough-textured, angular chips and chunks due to their high velocity flows. Contrastingly, pahoehoe flows appear to be smoothly folding and overlapping, seemingly creeping over a landscape because of their low-velocity and viscosity.5 Flow rate is determined by the discharge rate of the magma itself and the pitch, or slant, of the slope on which the lava flows.3 As can be inferred, pahoehoe flows are correlated with gradual slopes and lower discharge rates and a’a flows are the reverse of these conditions. Flows which begin as pahoehoe, if a steep decline is encountered, can convert to an a’a flow type in some instances.3

Other than just flow types, there are many other contributions to the re-vegetation of the area. Lava texture with relations to climate -a’a versus pahoehoe flows- can also affect vegetation abundance. A’a flows promote vegetation growth on wetter sites and vegetation in dry sites cling tend to cling to remnants of pahoehoe flows.2 Flow age can also affect re-vegetation rates and extensity. In a study done on the Mauna Loa volcano, biomass was recorded to be exponentially larger on older flows as opposed to younger, more recent flows. The younger lava sites studied were those of flows approximately 140 years old, the older flows were about 3000 years old. However, when paired with elevation studies, vegetation re-growth was highly dependent on the combination of all three factors; flow type, age, and elevation. A’a flows support higher levels of regrowth in lower elevation, dryer regions. In higher elevation regions, pahoehoe flows constituted the optimal grow site for vegetation.2

Many factors play a role in the re-vegetation of any area post-flow. One of the major and highly-examined influences contributing to the speed and extensity of growth is the regions climate.10 The Hawaiian archipelago, which is a term for group of islands4,is a notable study of this influence due to the varying climate surrounding the volcanic locations across the island regions. Hawaii is often famed for its tropical volcanic locations, where flows in such a humid environment quickly disintegrate into rich volcanic soil. However, they are not as commonly known for its arid, or xerophytic districts. In these locations, plant life is far less abundant and takes a much longer time for re-growth.6 Plant type can be distinguished in two categories: rock or soil based. Rock inhabitants can thrive much of anywhere, including the earlier mentioned xerophytic regions. However, soil dwellers will only survive and thrive on tropical volcanos, where soil formation is accelerated. They can also survive on older volcanos where soil has, over long periods of time, developed and accumulated.6

The native vegetation on Hawaiian lava flows are remain largely unthreatened by invasion of alien species.2 Plant invasion relies upon the amount of precipitation, which determines the quantity and type of invading forms, as well as the how close the region is to vegetated regions from which invasion could originate.10 It also is largely determined by the plant’s ability to survive the invasion and re-habitation; native plants have long-evolved to fit the harsh environment of this region and therefore generally outcompete alien invaders.9

Another feature effecting vegetation growth in the topographical nature of the region. Whether the landscape is natural or induced specifically by the volcanic aftermath, vegetation has evolved to fit these cyclic environments. Pit craters are a type of volcanic vent, or circular pit, that can provide a sanctuary for arid or tropical-based plants. They generally range from 100-300 yards in diameter, with approximately the same depth. Due to the extensive depth and steep walls, vegetation is protected from wildlife grazing and have optimal shade and moisture conditions, as opposed to exposed flow valleys.1 Therefore pit craters are said to have more normal and widespread growth patterns.7 Another topographical vegetation “hot-spot” are kipukas. Kipukas are oval holes, or depressions, created due to changes in the landscape.1 The irregularities in the topography manipulate lava flows to move around them, leaving vegetation within their boundaries untouched. Kipukas can occur in tropical volcanic-flow regions or arid regions.8

The type of plants that grow in specific lava-flow prone regions are largely reliant on the type of region-arid versus tropical- as earlier discussed. However, plant life is also largely reliant on other plant and biotic growth/regrowth in that same region.9 Survival plants-plants that have in some way survived a volcanic flow-are repeatedly recorded to assist and accelerate the rate of revegetation process in a variety of areas.10 After surviving plants, algae, nitrogen-fixing bacterium, and general cryptogamic pioneer communities are often represented to be the first invaders of the barren regions. Next are native seed plants, mosses, lichens, and ferns. Lichens are highly stratified to certain climates. Ferns are also heavily restricted; they are limited to mainly the tropics. Finally, years after initial flow, wood seed plants as well as herbaceous seed plants/grasses tend to start to take root and grow.10 Plant invasion and aggregation of the resettled plants are generally focused to favorable microhabitats like crevices and tree molds.9

As discussed briefly, there are many factors that contribute to revegetation post-basaltic flow: climate, flow type, elevation, age, native and surviving vegetation, topographical nature, and least of all, alien invaders. Basaltic flows can provide a unique environment for diverse plants and vegetation, if they can survive the blistering heat of the flowing magma, often unfavorable climate, as well as topography of their exclusive habitat.

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