

PRIMARY SUCCESSION: SURTSEY ISLAND



Surtsey is a volcanic island formed off the south coast of Iceland following a submarine eruption from 1963 to 1967. The eruption produced layers of volcanic ash, lava, and rock, creating new land with no pre-existing soil and no terrestrial ecosystem. This made Surtsey an ideal site for studying primary succession, where life colonises newly formed land.

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Stages of Primary Succession on Surtsey

Pioneer Community (1960s–early 1970s)

- Early colonisers included microorganisms (including bacterial and fungal spores), transported by wind, ocean currents, and birds.
- In 1965, the first vascular plant, *Cakile maritima* (sea rocket), was recorded.
- By the early 1970s, approximately 10–20 plant species had been recorded, although not all were permanently established.
- At this stage, true soil had not yet developed, and organic matter was minimal.

Development of Seral Communities (1970s–1990s)

- Seabirds, particularly gulls, began nesting on the island, significantly accelerating succession.
- Seabirds acted as ecosystem engineers, increasing nutrient input through guano and introducing seeds.
- Mosses and lichens, along with early vascular plants, contributed to moisture retention and substrate stabilisation.
- Grasses and other vascular plants spread, especially in areas influenced by bird colonies.



- Species diversity increased over time, although distribution remained uneven across the island.

Later Stages of Succession (2000s–Present)

- By the early 2000s, more than 60 plant species had been recorded, with numbers continuing to increase.
- A developing soil layer formed through weathering of volcanic material and accumulation of organic matter, particularly from seabird guano.
- Some woody plants, including willows (*Salix*), have appeared in nutrient-rich areas, especially near bird colonies.
- The island now supports seabird colonies, insects, and diverse plant communities, although ecosystems vary across different parts of the island.
- Surtsey remains a developing ecosystem and has not reached a stable climax community.

Key Factors Affecting Succession

Abiotic Factors

- Harsh climate (strong winds, salt spray)
- Porous volcanic substrate with low water retention
- Initially low nutrient availability

Biotic Factors

- Seabirds acting as ecosystem engineers, introducing nutrients and seeds
- Increasing competition between plant species
- Role of microorganisms in decomposition and soil formation

Human Influence

- Surtsey is a strictly protected research site, with highly restricted access.
- This prevents artificial introduction of species and allows succession to proceed naturally.

Conclusion

Surtsey Island remains a living laboratory for studying primary succession, ecosystem development, and species colonization. Over time, the island has transitioned from barren volcanic rock to a thriving ecosystem, highlighting the slow yet progressive nature of ecological succession.

This case study illustrates the importance of pioneer species, nutrient cycling, and environmental factors in primary succession and serves as an example of how ecosystems develop over time from newly exposed land.

