The salinity of a floating forest

Wesley Bruce

Fresh water will float on salt water if undisturbed. The extinct, Carboniferous floating forest described by Joachim Scheven would eliminate wind- and wave-driven mixing within and below the 'mat', stabilising a salinity gradient of fresh, dew fall water, on a salty sea. This would allow both salt- and fresh-water fauna to coexist in the ecosystem and would explain the mix of fauna found in the Carboniferous coal measures.

Joachim Scheven has proposed an interesting theory that the Euro-American coals have not grown in place but formed when a huge forest of floating aquatic plants was swept on shore and buried in the catastrophe of Noah's Flood.

Scheven's video[1] and published material[2–5] indicates that the *Lepidendron* and *Sigillaria* species of the Carboniferous coals were aquatic plants. These are the giant club moss trees described as growing in coastal swamps by evolutionists. His data indicates that the trunks and underwater roots (stigmaria) are hollow. Hollow straw-like appendices grow radially from the stigmaria. A buoyant supporting mat is formed from the partly air-filled appendices.

One major question that arises is whether or not the floating forest was on fresh or salt water. The size and ecological significance of the forest depends on the question. Interestingly it may have been both!

Fresh and salt water

Fresh water will float on top of salt water if neither is disturbed.[6] The impact of raindrops and the action of wind and waves speed the mixing of fresh and salty water to form a uniform salinity. Diffusion on its own is generally very slow.

All forests reduce wind speed. The interlocking mat of stigmaria and appendices would tend to damp waves. The leafy upper stems and branches of the major species in the floating forest would tend to direct all precipitation down the plant's stems and trunks rather than creating large droplets, which fall into the sea surface mixing violently. The floating forest would be subject to normal pre-Flood dewfall.[7] Shading by the floating forest would mean that the seawater below would be cold. Evaporation would be minimal if not totally eliminated. Locally, transpiration would be the primary source of atmospheric water vapour[8] and thus any precipitation would be closely tied to the previous day's transpiration. The addition of one salt-water tolerant species to the plant mix in the ecosystem would push the transpiration volume up increasing the total precipitation above the total evapotranspiration losses. The total thickness of the fresh-water layer would tend to increase.

Since dewfall is cold, fresh water, it would tend to form a film over all plant surfaces flowing smoothly down to form a film on the top of the colder seawater. Large volumes of fresh and salt water don't mix quickly. Fresh water can be found a hundred kilometres off shore from the Amazon River. In estuaries, tidal salt water permeates under fresh water producing a salt-water wedge.[6] Experiments with salinity gradients in solar salt ponds indicate that, even with hot salt water under cooler fresh water, mixing is slow enough to be minimised by simple floating mats of plastic that break up the mixing flows and wind and wave activity. With cold, salt water below and fresh water above, only a small amount of diffusion, which is heat driven, would tend to occur at the surface between the two water volumes.

Water-permeable sand dunes and sand islands retain fresh water for similar reasons. Mixing flows caused by wind, waves and temperature differences are blocked by the sand, which slows all flows down. Capillary forces lift the freshwater above the mean sea level, thus reducing the surface area of the boundary between the fresh water volume (called a fresh water lens by those that teach agriculture in the Pacific Islands[9]) and the salt water that permeates the sand underneath the fresh water.

High capillary forces are generated when materials with high surface areas are pressed together so that the forces of surface tension are maximised and can counter gravity and other forces. If the floating forest's mat of appendices were dense enough, there could be very high capillary forces operating in the mat holding the fresh water in it. The floating mat would hold water like a sponge and yet still be buoyant. This would tend also to ballast the floating forest so that it would be stable.

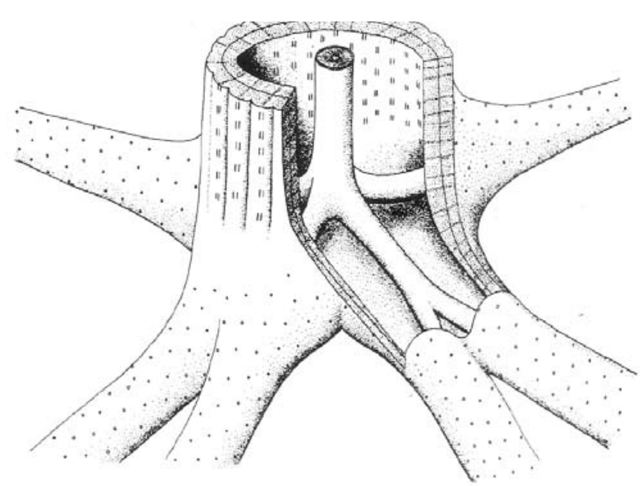


Figure 1. *Reconstruction of a lycopod tree stump showing its hollowness between the central cylinder and the outer rind.*

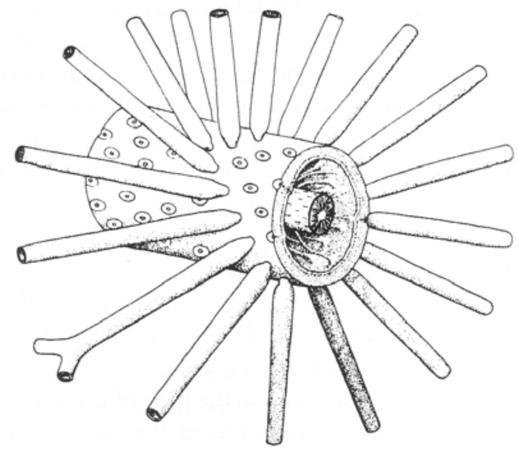


Figure 2. Reconstruction of the central stigmarian root with its radial appendices. Notice again the hollowness around the central cylinder (stele) and the scars on the outer tissue (bark) where the appendices were attached.

The thickness of the fresh-water layer

The total thickness or depth of the fresh-water layer would depend on an interplay of variables. These would include dewfall rates, the rate at which the plants and animals take up the fresh water, the rates of diffusion and evaporation, and the rates of water intake of salt-water–tolerant plant species in the ecosystem. The fresh-water thickness would change slowly, varying with day length and season. It could range from a few centimetres to several metres depending on the above variables. It should be calculable given reasonable estimates of diffusion rates at various temperatures, evaporation and estimates of the dew volume from the plant surface area. This would give a minimum thickness, not taking into account the percentage of salt tolerant plants.

A large variation in salinity would occur at the edges of the mats and at any large holes in the mat. These areas would be populated by plant species with the highest tolerance for wind, waves and salt water. It is highly probable that the seedlings of the floating forest would be more salt tolerant than the mature adults of the same species, since the unshaded empty patches in the forest and areas on its edge would be the only places available for seedlings to take hold.

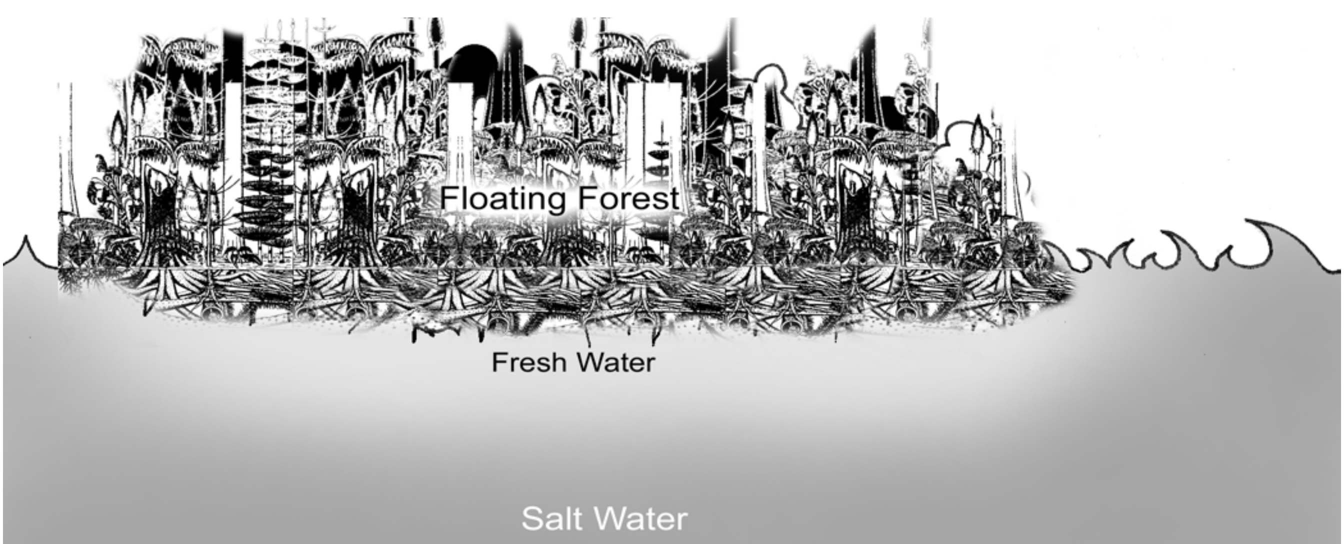
Normally the greater density of salty water would produce what is called a halocline,[10] a vertical graduation in salinity with the salinity and density of the water increasing with depth. The surface of the world's oceans has an unstable halocline created by evaporation concentrating salt in the warm surface waters. Surface water has high temperature and high salinity. This layer traps cooler nutrient-rich water below, starving the sunlit surface water of fertility.

Nutrient-rich up-wellings of deep water occur where winds or currents move the infertile salty surface water away exposing and drawing up the cold, fertile water. The few small fertile regions of ocean surface that are so important to the world's deep-sea fisheries are produced by these up-wellings.

By shading the surface over a relatively large area the floating forest would tend to prevent the formation of the halocline that blocks cold nutrient rich waters from reaching the surface. The colder salt water a few meters below the forest would mix freely with deeper cold water below raising nutrients to the surface. Thus the forest itself would produce an up-welling of fertile water directly under it. The forest's plants would still be able to penetrate to the nutrients because they would partly penetrate the fresh water to salt water gradient with their appendices.

Implications for Carboniferous coal deposits

The presence of a fresh-water layer floating on a sea



A diagrammatic representation of a floating forest. The latticework of roots would protect the rainwater and dew from mixing with the salt water. The lattice of roots would also support the formation of peat from dead organic material.

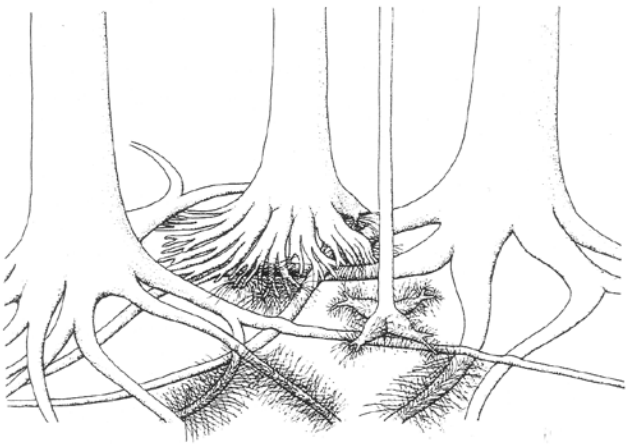


Figure 3. *Reconstruction of how a floating lycopod forest might have looked, with stigmariae and appendices interwoven to provide the framework structure for a peat mat. The drawing is based on real trunks in various European museums.*

of salt water with the floating forest stabilising the salinity would also explain the unusual mix of salt- and fresh-water fauna found in the deposits.[8,11] Fossil amphibians are very common in the Carboniferous coals. Amphibians are not able to tolerate salty water. They have a water-permeable skin that allows salt to draw water out of their body, killing them quickly. This is why some creationists have seen the salinity of the floating forest as so critical to the theory's validity.

If the floating forest has fresh water in the mat of appendices or in a thick surface layer then the amphibians would be able to survive in that layer. Large dragonflies and fresh-water molluscs are also found in the coals.[8] This tends to confirm the hypothesis that the ecosystem is partly fresh water. The coals also have salt-water–tolerant fauna such as fish, molluscs and reptiles. These would probably feed below the mat. The reptiles would feed across the salinity boundary but would nest on the mat.

Such a floating forest also explains the anatomy and physiology of the amphibians. Many have large, flat shovel-shaped heads with fully calcified bones.[12] These allow the amphibians to push between the appendices quickly. These animals also have a very flexible body with many skeletal parts composed of cartilage. This allows them to worm their way through the appendices. The dental structure of some of the amphibians appears to be adapted to filtering out small crustaceans and larva from a mouth full of water. This would be expected since the buoyant mat would be the perfect habitat for many species of small mollusc or crustaceans.

The root appendices would tend to exclude large fishes by entangling fins. Legged animals would be able to propel themselves forward against the appendices giving them an advantage within the buoyant mat.

The layer of fresh water in the mat would also support some hardy land plants growing on a mulch of fallen leaves and appendices squeezed up above the water line. This would explain the presence of ferns[4] in some of the floating forest deposits. Ferns are tolerant of wet fresh-water environments. The ferns would tend to bind to together the mat making it stronger and more stable. The larger the area of the floating mat, the more stable the fresh-water layer.

Conclusion

It is theoretically possible for the floating forest as described by Joachim Scheven to accumulate and hold fresh water in a layer on the surface of a salt-water sea. Such an ecosystem would support the entire fauna found in the Carboniferous strata even with the great range of salinity requirements of the various species of flora and fauna.

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Wesley Bruce is a member of the Canberra AiG Support Group, Australia. He has a Bachelor of Science in human ecology and geography from the Australian National University, Canberra, with archaeology, physics, and some planetology and cosmology. He was raised as a creationist yet topped his high school classes in evolution (*to win we must know our opponent*).