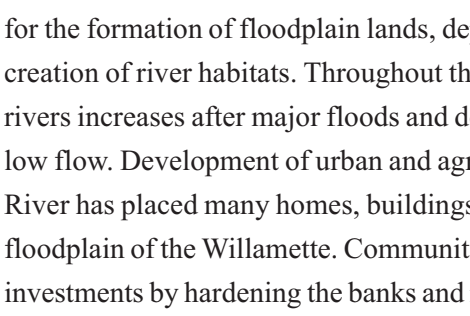
Floods and Floodplains in the Willamette River

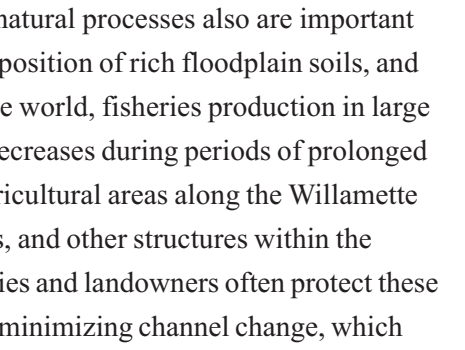
Floods raise many concerns for communities living along major rivers such as the Willamette River, but these natural processes also are important for the formation of floodplain lands, deposition of rich floodplain soils, and creation of river habitats. Throughout the world, fisheries production in large rivers increases after major floods and decreases during periods of prolonged low flow. Development of urban and agricultural areas along the Willamette River has placed many homes, buildings, and other structures within the floodplain of the Willamette. Communities and landowners often protect these investments by hardening the banks and minimizing channel change, which leads to reduced channel dynamics and impaired ecological conditions.

Sources of Information

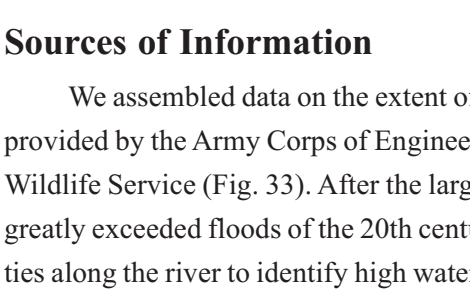
We assembled data on the extent of major historical floods from records provided by the Army Corps of Engineers and digitized by the U.S. Fish and Wildlife Service (Fig. 33). After the large floods of the late 1800s, which greatly exceeded floods of the 20th century, the Corps sent letters to communities along the river to identify high water marks, and they also surveyed particular areas in an attempt to identify the boundaries of inundation for the floods of 1861 and 1890. The Corps conducted a major flood study after the floods of 1943 and 1945, which carefully demarcated the boundaries of flooding. We combined flood extent maps for 1861, 1890, 1943, 1964, and 1996 to create a map of the historically inundated floodplains of the Willamette River from Portland to Eugene (Fig. 35).



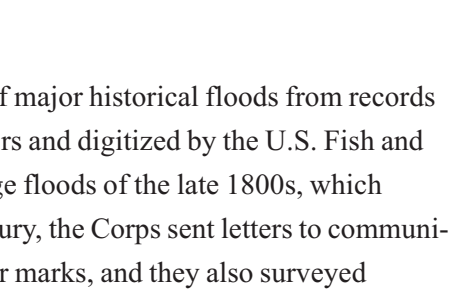
Portland - 1862



Portland - 1890



Willamette Falls - 1964



Salem - 1943

Figure 33. *Examples of historical floods experienced by communities along the Willamette River since the 1860s. In addition to the winter floods shown here, Portland also historically underwent early summer flooding from spring snowmelt flows on the Columbia, which would "back up" the lower Willamette. Photos provided by the Oregon Historical Society.*

Flood History

The Willamette River has experienced numerous floods over the last 150 years (Fig. 33). Floods in recent years, such as 1964 and 1996, gained wide public attention and each was proclaimed the flood of the century. The hydrologic record from the gauging station at Albany clearly indicates that many previous floods exceeded the recent floods (Table 9). Even when considering only a single flood from each year (Fig. 34), floods in 20 years exceeded the 1996 flood and seven floods exceeded it in the decade 1900-1910. The Army Corps of Engineers constructed eleven flood control reservoirs between 1949-1964. These floods have dampened peak flows by 30-50%, depending on the magnitude of the flood. Flood control reservoirs are more effective for smaller floods, and the extent of peak reduction increases with lower flood flow. Recent climate trends show lower precipitation from 1970 through 1990 (Fig. 49, p.34). Communities along the river may develop perceptions of the river and limitations of its flooding that are not consistent with the actual history of the Willamette River.

Historical floods have inundated large areas of the Willamette Valley.

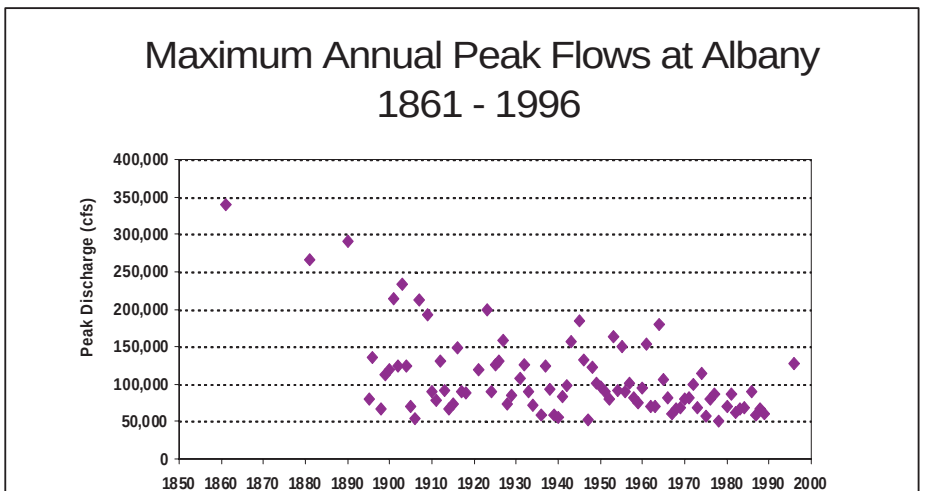


Figure 34. *Maximum flood discharges recorded at the Albany gauge from 1861 to 1996. The Albany gauge has the longest flow record on the Willamette River. Some years, such as 1907 or 1938, had three or four flooding events with flows greater than 50,000 cfs. Only floods greater than 50,000 cfs and only the largest flows in a given year are plotted.*

Peak Flows (in cubic feet per second) of Major Floods at the Albany Gauge				
1861	1890	1943/1945	1964	1996
340,000	291,000	210,000	180,000	117,000

Table 9. *Maximum discharges recorded at the Albany gauge for the four major floods for which the Army Corps of Engineers has mapped flood boundaries.*

The floods of 1861 and 1890 covered an area of more than 320,000 acres (Table 10). This flood extent is the best scientific source for delineating the functional floodplain of the Willamette River. In the lower section of the river, the functional floodplain from the 1861 and 1890 floods is consistent with the 100-yr floodplain identified by the Federal Emergency Management Agency for floodplain management and flood insurance (Fig. 35). The upper section of the Willamette River between Albany and Eugene is a broad complex floodplain that is relatively unconstrained by adjacent hills and mountains. The FEMA 100-yr floodplain occupies 49.2% of the area inundated by historical floods in the upper river. From Albany to Newberg, the Willamette River flows through several hills and mountain ranges which locally constrain the channel and create a floodplain that varies in lateral extent. The lower Willamette River from Newberg to Portland flows in a basalt trench that was formed by a series of lava flows that date to before the uplift of the northern Cascade Mountain Range. Floodplain development is extremely limited and floodplains are very narrow in this reach of the Willamette River.

During the recent floods of 1964 and 1996, the Willamette River fully occupied its historical floodplain in the lower, narrow river and occupied most of the historical floodplain in the middle section of the river (see Fig. 35). The flood boundaries of the recent floods were substantially less than the extent of the historical floodplain in the upper section of the Willamette River. This is caused by 1) the lower flows in recent floods, 2) dampening of peak flows by flood control reservoirs, and 3) channel alteration and revetments. As a result, floodplain function was diminished and human property was protected. Unfortunately, this may lead some individuals to place structures closer to the river and to encroach on the floodplain. Future floods may be more similar to historical flood magnitudes (even with flood control). Property losses during major floods are likely to increase if communities place more valuable structures within the influence area of flooding.

Area of The Willamette Valley Inundated by Major Floods				
	1861/1890	1943/1945	1964	1996
Acres	320,337	149,797	152,789	194,533
Hectares	129,638	60,622	61,833	78,726

Table 10. *Area of Willamette Valley inundated by major floods since 1860. Floods of 1860, 1861, and 1890 were combined, and floods of 1943 and 1945 were combined.*

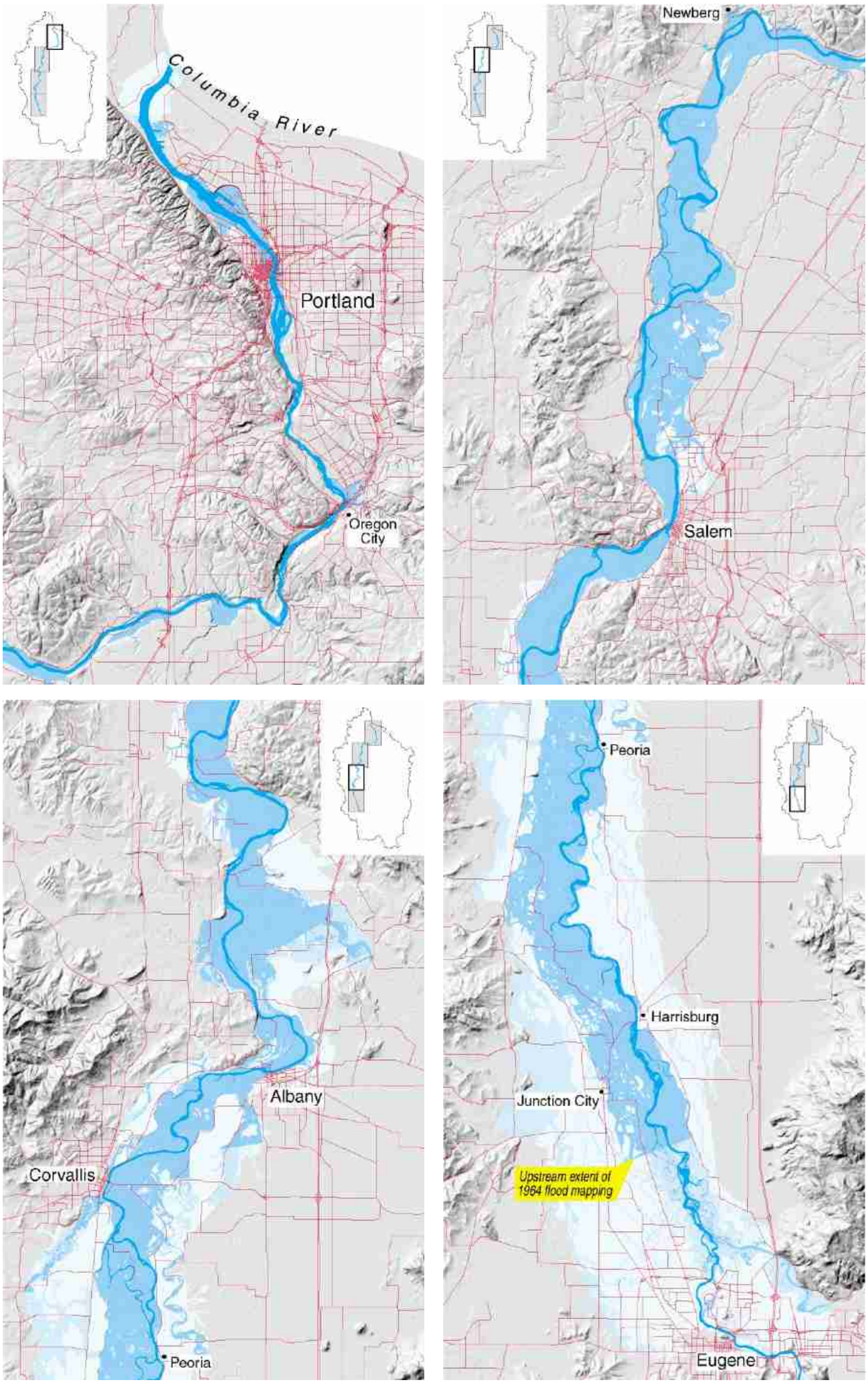


Figure 35. *Maps of the extent of historical floods relative to FEMA 100-year floodplains and current active channel.*