A. Mangroves – Mangal – from mangue (tree) and grove (stand of trees)
    a. Replace salt marsh as the dominant coastal ecosystem in subtropical and tropical regions, facultative halophytes

    b. Distribution
        i. 240,000 km2 Worldwide
        ii. 2,700 km2 in Florida
        iii. 68 spp world wide
        iv. 10 spp in Americas (New World)

    c. Found on coastlines between 25° N and 25°S latitude, dependent on temperature
        i. Rhizophora - survive 2-4° C for 24 hrs
        ii. Avicennia – survives 2-4° C for several days

B. Three main genera
    a. Rhizophora (red mangrove)
        i. *R. mangal* and *R. racemosa* most common New World spp
        ii. High prop roots and dangling roots are common (Figure 11-8)
        iii. More cold tolerant
    b. Avicenna (black mangrove)
        i. *A. germanaus* most common in New World
        ii. Can tolerate very high salinity (60 ppt) and very anoxic conditions
        iii. Known for having pneumatophores
    c. Lagunicularia (white mangrove)
        i. *L. racemosa* most common in New World
        ii. Affinity for lower salinity areas

C. Geomorphological settings –
    a. need gentle wave/tidal action to bring nutrients
    b. salinity allows them to out compete FW species

D. Hydrodynamic settings
    a. Fringe – protected shorelines, some canals, rivers and lagoons
        i. Grow to 13 m tall
        ii. Accumulate organic matter
        iii. Found in S. Fla, Puerto Rico, Mexico, Texas
        iv. Avicennia found in salinity to 59 ppt, Rhizophora to 39 ppt
        v. Overwash islands – one type of fringe mangrove
            1. Rhizophora dominated
            2. sensitive to ocean pollution
    b. Riverine – along tidal affected rivers
        i. Grow to 21 m tall
        ii. Rhizophora dominated, but with few prop roots
        iii. Avicennia and Lagunicularia also present
        iv. Salinity 10-20 ppt

c. Basin- inland depressions, behind fringe, in stagnant water
    i. Grow to 9m tall
    ii. Soil conditions: highly anoxic, saline
    iii. Avicennia and Lagunicularia with many pneumatophores
    iv. If salinity >50ppt: Avicennia, if low: lagunicularia, 30-40ppt mixed forest
d. Dwarf – isolated, low productivity, low FW, low nutrients
    i. Grow to 2-5m shrubs
    ii. Fringe of everglades, Florida Keys
    iii. Hammock – one type
        1. buildup of peat
        2. Rhizophora dominated

E. Understory – lacking due to variety of stressors
    a. Mangrove ferns (*Acrostichum spp*) are common, 3 spp worldwide

F. Salinity
    a. Not required for mangroves
    b. Much higher in soil than in water

G. Zonation – Figure 11-7

H. Adaptations
    a. Salinity – exclusion and excretion
    b. Prop roots and drop roots – Rhizophora
    c. Pneumatophores – Avicennia – 20-30 cm above sediment
    d. Lenticels found on a & b, let oxygen into plant, moves through arenchyma to root rhizosphere
    e. Viviporous seedlings – Rhizophora – seeds germinate on tree
        i. Hypocotyls (seedling) drops, floats till touches sediment, roots

I. Crabs – mangrove janitors
    a. Burrow, oxygenate soil, drag leaves into soil, aid in decomposition
    b. Selectively eat dropped hypocotyls

J. Hurricanes – mangrove succession to stable community in average time between major hurricanes
    a. Wipe out larger mangroves, small trees in gaps survive and act as a seed bank

K. Mangrove effects on estuaries
    a. Net export of organic matter and nutrients
    b. Provides nursery areas and food sources for fisheries