## Contents and advisors and advis

Prej	face			pag	ge ix
	of Syr	nbols			xi
		daments			xiii
100	4 D.				1
1	A Bi	ief History of Leaf Color			-110
2	Leaf	Biophysics			12
	2.1	Leaf Anatomy			14
	2.2	Leaf Shape and Venation			21
	2.3	Leaf Biochemical Composition			22
	2.4	Dry Matter			38
	2.5	Natural Range and Relationships of Leaf Constituents			40
	2.6	D 1 Freshetian of Loof Constituents			43
					48
3		etroscopy of Leaf Molecules			48
	3.1	Theory			54
	3.2	Pigment-Specific Absorption Coefficients			60
	3.3	1			63
	3.4	Cell Wall Constituent-Specific Absorption Coefficients	Ing Three-Dimensions		68
	3.5	Other Minor Constituent-Specific Absorption Coefficient	Three-Dimensional Str		70
	3.6	Refractive Index of Leaf Constituents			, 10
4	Mea	surement of Leaf Optical Properties	The RAYTRAM Model		74
	4.1				74
	4.2	What to Measure?			84
	4.3	Measurement of Leaf Color			88
	4.4	Measurement of Leaf BRDF/BTDF			94
	4.5	Massurament of Leaf DHRE/DHTE			106
	4.6	Portable Photometers and Other Probes			113
	4.7	Measurement of Leaf Absorption Profiles			118
	4.8	Measurement of Leaf Surface Temperature			120
		Measurement of Leaf Electrical Properties			121

vi Contents

5	Leaf	Optical Properties in Different Wavelength Domains	124
	5.1	Surface Scattering	124
	5.2	Volume Scattering of the Entire Leaf	136
	5.3	Leaf Color	161
			162
	5.5	Near-Infrared and Fourier Transform Infrared Spectroscopy	167
6	Varia	ation Due to Leaf Structural, Chemical, and Physiological Traits	170
	6.1	Structural Sources	170
	6.2	Chemical Sources	179
	6.3	Physiological Sources	185
	6.4	Intraspecific Variation	189
	6.5	Interspecific Diversity	190
	6.6	Climate Change	194
7	Varia	ations Due to Leaf Abiotic and Biotic Factors	195
	7.1	Abiotic Factors	195
	7.2	Biotic Factors	estrydgold head 214
8	Comp	nprehensive Reviews of Leaf Optical Properties Models	ousmAlbasid LL 229
	8.1	Different Approaches for Leaf Diffuse Optical Properties	230
	8.2		dooi81922 246
	8.3	Different Approaches for Leaf Surface Reflectance Properties	15 million value 251
	8.4	4 - 41 - 77 - 7 - 1 - 1 - 1 - 1	262
9	Mode	deling Leaf Optical Properties: PROSPECT	265
	9.1	The PROSPECT Model	265
	9.2	Direct Mode: Sensitivity Analysis	271
	9.3	Model Inversion	283
	9.4	Link of PROSPECT with a Leaf BRDF Model	286
10	Mode	deling Three-Dimensional Leaf Optical Properties: RAYTRAN	292
	10.1	Three Dimensional Structure of Plant I eaves	292
	10.2	Construction of a Three-Dimensional Leaf Model	302
	10.3		307
	10.4	Radiative Transfer Simulations	308
	10.5	Coupling RAYTRAN with a Photosynthesis Model	316
11	Extra	raction of Leaf Traits	320
	11.1	Combinations of Narrow Bands	320
	11.2		328
	11.3		332
	11.4		340
UAL	11.5		349
	11.6	Spectral Mixture Analysis	351

	Contents	vii
11.7	Artificial Neural Networks	352
11.8	Model Inversion	354
12 Appl	actions of Loof Ontics	357
	cations of Leaf Optics  Leaf Energy Budget	357
12.1		364
12.2		366
12.3		374
12.4		381
12.5		385
12.0		387
12.7		393
12.0	a same manufactor of shutchelements to most nunccommunities. Like vale all	397
12.10	have a flames sale of the banks have formed on them: In their book Astress Figure	401
12.10	Science and Art	r book
Conclusio	are than 300 breathtaking photos of leaves taken from their travels around the wo	404
Appendix	A Glossary and Acronym List	406
	R Leaf Molecules	423
	C Planck's Law	435
11	D. Padiometry	439
	E Fresnel's Equations	442
11	F Beer–Lambert Law	452
	G Kubelka–Munk Theory	455
* *	H Global Sensitivity Analysis	462
	I Leaf Three-Dimensional Reconstruction	464
	I Leaf Online Databases and Models	469
Reference	mure's Palette: The occurred of Plant Color Alice, 2001) is one of the mot books	473
Index	plant color, taking the reader through its social history, ecology, evolution, and bis	544

Color plate section can be found between pages 210 and 211

plants as well as when under environmental stresses. Visual plant defenses (camouflage, mimicry and aposematism via coloration, morphology, and even movement) against herbivores is the central topic

from adding sections on canopy and landscape-scale processes, because of the impractical length of